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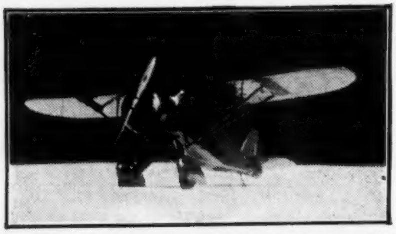

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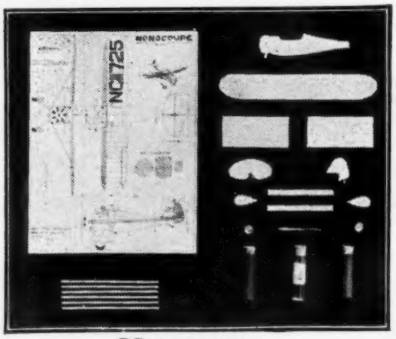

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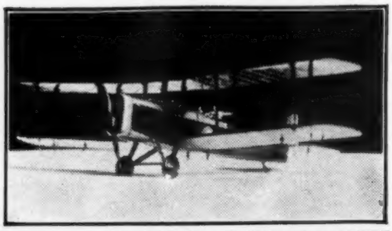

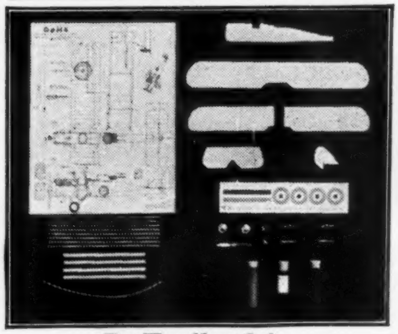

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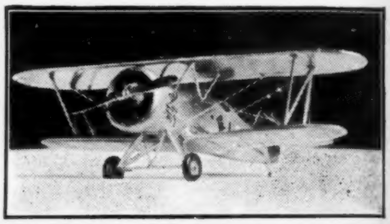

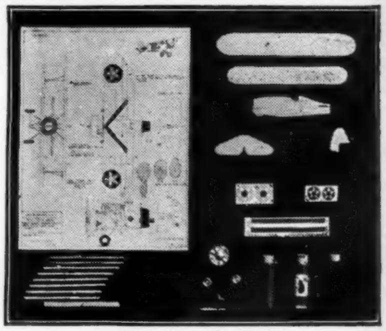

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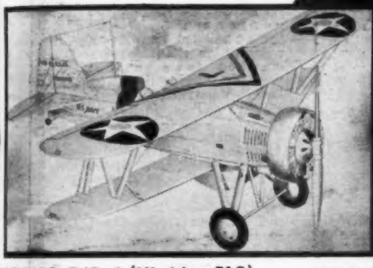

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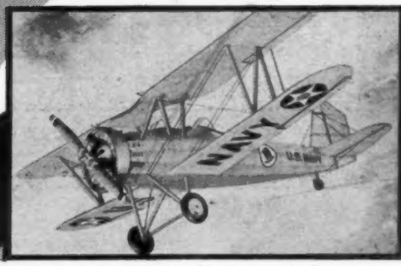

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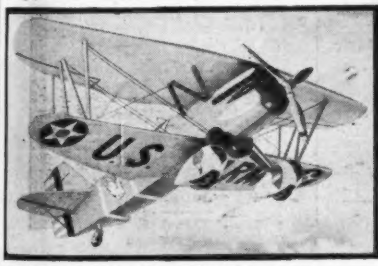

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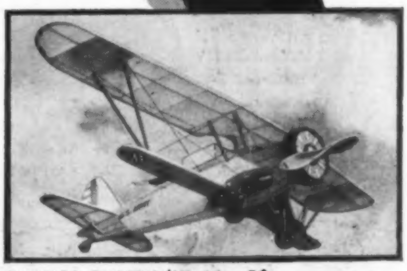

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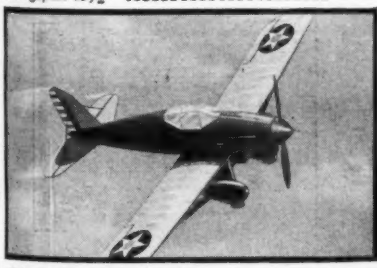

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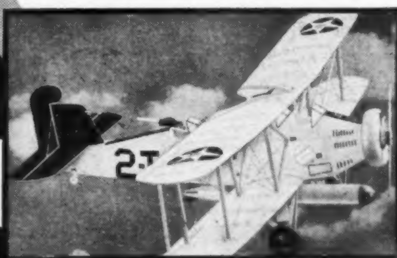

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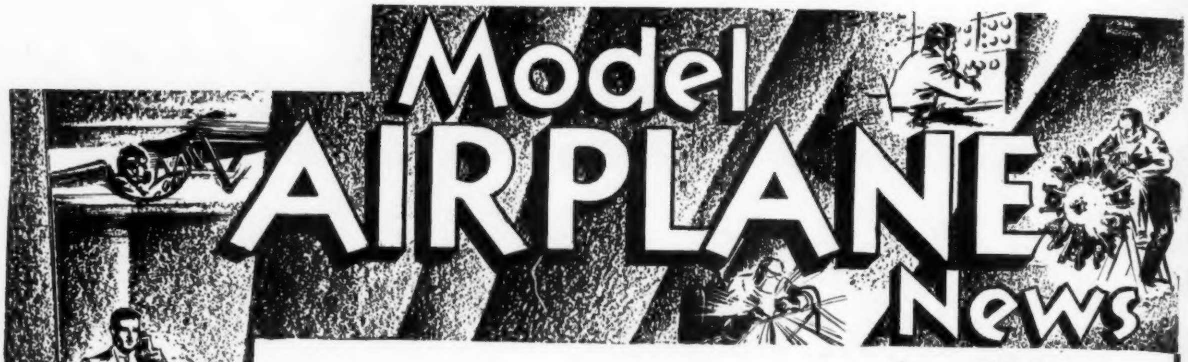

VOL. XII *NO. 3*

Edited by Charles Hampson Grant

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APRIL, 1935

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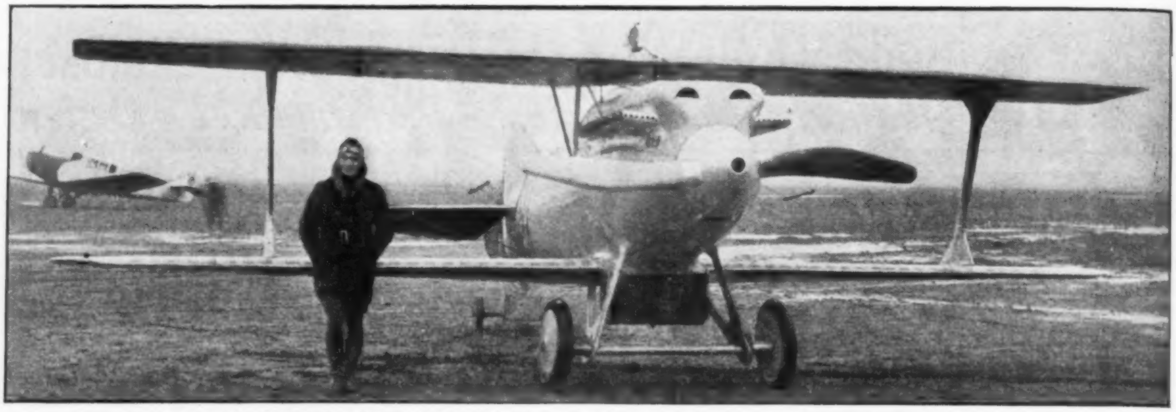
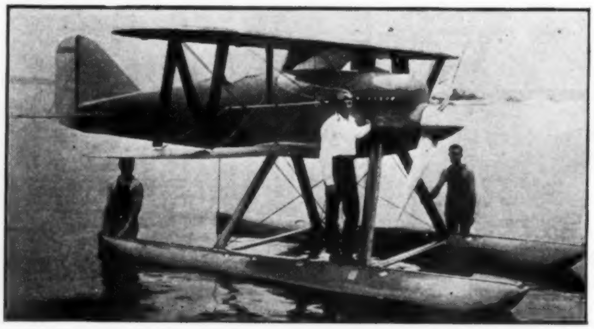


The Verville-Packard Racer, flown by Lt. C. C. Mosely, U.S. Army, in the 1920 Pulitzer Race

Speed Wings

Racing Planes That Have Made Aviation History and How They Have Influenced the Design of Modern High-Speed Ships

By H. LATANE LEWIS II



Here is the 1923 Schneider Cup Winner, the Navy Curtiss Racer C-R-3, one of the first high speed racers

TWENTY-ONE years ago, a clumsy box-kite contraption with a sputtering engine flew at a speed of 45 miles per hour to win the first Schneider Cup Race. The last race was won at 340 miles per hour and word has recently come from Italy of a plane having reached the colossal speed of 440. Thus, in the brief span of a little more than two decades, the rate at which aircraft can fly has been multiplied more than eightfold.

The progress has been made step by step. Each year designers have "suped up" their engines, have added a new feature here and eliminated something there to bring about faster and more efficient models. And the modern airplane, both in its commercial and military forms, is a direct evolution of these racing planes.

Let us go back and look at some of the significant developments. The first 7 years following the World War brought out features that changed the whole design of aircraft. The racing plane of one year became the standard plane of a few years later. It is with this important period that we shall chiefly deal.

The Verville-Packard Racer that won the Pulitzer Race of 1920 was the cleanest design that had been produced anywhere in the world up to that time. Its outstanding feature was the single "I" struts which supported the wings. This was a daring departure from the conventional planes of that day and although not favorably looked upon by the industry at the time, the idea has recently taken a new lease on life and these "I" struts are being incorporated into some of the latest American planes, notably the new custom-built Beechcraft. Another feature of the plane was the smooth skin fuselage, which has become the goal of most present day designers. The ship was powered with a 600 horse-power Packard engine and had a speed of 178 miles per hour.

"N" struts, which are now used on so many biplanes, got their first big test in high speed aircraft in the Pulitzer Race of 1921 when they were used on the Curtiss-Navy Racer. This little ship attained the then remarkable speed of 200 miles per hour. It is true that "N" struts had been used in a number of foreign planes previous to this time—chiefly the wartime Fokker D-7—but had been frowned upon by American designers. The performances of the racer proved the superiority of "N" construction and the following year it was incorporated into a service type Navy seaplane, the TR-3. This ship won the 1922 Curtiss Marine Trophy Race for standard Navy planes.

Another interesting entry in the Pulitzer Race of 1921 was a "suped-up" Sopwith *Dolphin* with an 8-cylinder, low-compression, Hispano-Suiza engine, of 200 horse-power. This ship had been developed by the British as a high speed scouting plane. The two radical features of the plane were the negative stagger or setback, of the wings, and the open center section of the top wing, permitting open visibility. The negative stagger was a novel

The Curtiss Triplane, developed during the World War and flown in the Pulitzer Race, 1920, by Lt. W. B. Haviland

The JR-3, U.S. Navy Seaplane, winner of the Curtiss Marine Trophy, 1922, and forerunner of modern Navy ships


The Thomas Morse Racer TM-22 of 1924. This ship was covered with corrugated sheet metal


The U.S. Army Curtiss Racer CD-12, (1924). Evolution into the Hawk type is evident

idea and met with a good deal of derision at the time. However, this arrangement of the wings is now being used in the new high performance Beechcraft A17F and proves that the designers of the little *Dolphin* were on the right track after all.

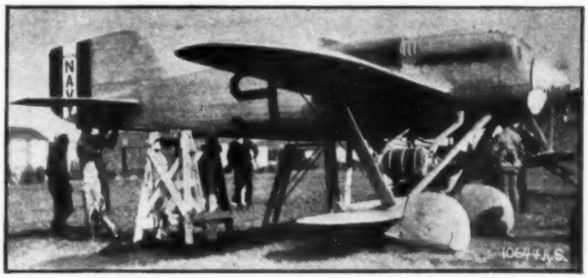
The open center section brought out the advantage of increased visibility in this direction and started designers on an intense study of the question. The result has been the cutting away of part of the center section of many of our military and Naval planes, and in some instances of building the top wing flush with the fuselage, as in the Curtiss F9C-2 and the Berliner-Joyce shipboard fighter.

A plane that tolled the death knell of its type was the Curtiss Kirkham Triplane 18-T, powered with a Curtiss D-3000 12-cylinder engine of 400-horse-power. Triplanes had been used to some extent in large heavy bombardment planes and Fokker put out a triple pursuit job during the War. The 18-T settled the question, however, that triplane construction was inefficient for high-speed planes and no more single-seaters of such a type were constructed.

The year 1922 brought out two racing planes that have had a very significant effect upon the ships that are familiar to us today. One of them was the Verville-Sperry Racer that competed in the Pulitzer Race of that year. This plane was the forerunner of the modern low-wing retractable landing gear types.

The plane was built to order for the Army Air Corps and was a cantilever low-wing monoplane with a Wright H-3 400-horse-power "Super-Fighter" engine. Each wheel of the landing gear folded outward into the wing. The fuselage was constructed of steel tubing and the forward part was covered with aluminum. While not the first low-wing monoplane by any means, it was one of the first to reach a


Verville Sperry Racer, forerunner of low wing ships. (1925)


Navy Wright Sesqui-plane NW-1, 1924 racer

high degree of structural strength and aerodynamic efficiency. There was no external bracing as had been the custom in previous low-wing designs. The little ship had a speed of 191 miles per hour.

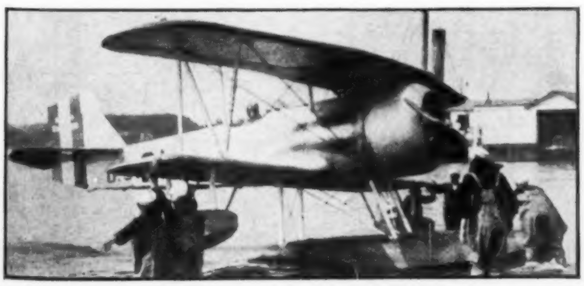
The other plane was the NW-1 Navy Wright Sesqui-plane, or one-and-a-half plane, which has had a great effect upon large transports of the present day. In addition to the main wing, an additional half wing was attached to either side of the landing gear. This idea has been carried out in some of the modern Sikorsky models and other well-known big ships.

This plane was developed by the Navy in conjunction with the Wright Company. It competed in the Pulitzer Race of 1922 and had a speed of 207 miles per hour.

The beginning of all metal construction in racing planes also appeared in 1922. This was the Thomas Morse TM-22, a distinct step forward and a marked departure from anything that had been seen before. The wings of this plane curved up sharply over the fuselage and the gas tank was carried in the center section. A radiator shaped with an open mouth through which the air flowed, like a miniature ring cowl of the later days, was carried under the fuselage between the landing gear struts. The TM-22 was powered with a Packard 600-horse-power engine and developed a speed of 155.5 miles per hour.

The Army Curtiss Racer CD-12 brought out the use of wing radiators. Previously, radiators of various types had been used, principally a bulky affair slung beneath the fuselage. The CD-12, however, eliminated this source of parasitic drag with radiators streamlined perfectly into the wing surfaces. It proved the advantage of this type of construction by walking away with the 1922 Pulitzer Race at a speed of 206 miles per hour and became the fastest machine in the world at that time.

The following year Curtiss came out with two other big steps forward. The


The Curtiss F7C, Curtiss Marine Trophy winner of 1929, fitted with first N.A.C.A. cowling


The Curtiss Racer R3C-1, winner of both Schneider Cup and Pulitzer Race in 1925

R2C-2 brought out improvements in using push rods and internal cables for control. No external cables were used, nor were there any "horns." Compare the modern plane, free from control wires and pulleys, with the box-kite ships of wartime days, and the vast importance of this improvement will be evident.

The R2C-2 was also equipped with the first successful metal airscrew, known as the Curtiss-Reed duralumin propeller. This propeller was simply a single metal sheet twisted in the proper shape. It was proved that by using a metal propeller, speed could be increased over the conventional wooden type by 10 miles per hour.

This plane proved its worth when, rigged as a landplane, it won the Pulitzer Race at a speed of 243.68 miles per hour. It was powered with the now famous Curtiss D-12A 500-horse-power engine.

The Navy Wright Fighter, which appeared the same year and also competed in the Pulitzer Race, paved the way to the use of 3-blade propellers on high-speed aircraft. With the experience gained in the operation of this ship, the trend has been more and more to put 3-bladers on pursuit and other small jobs as well as on the heavy machines.

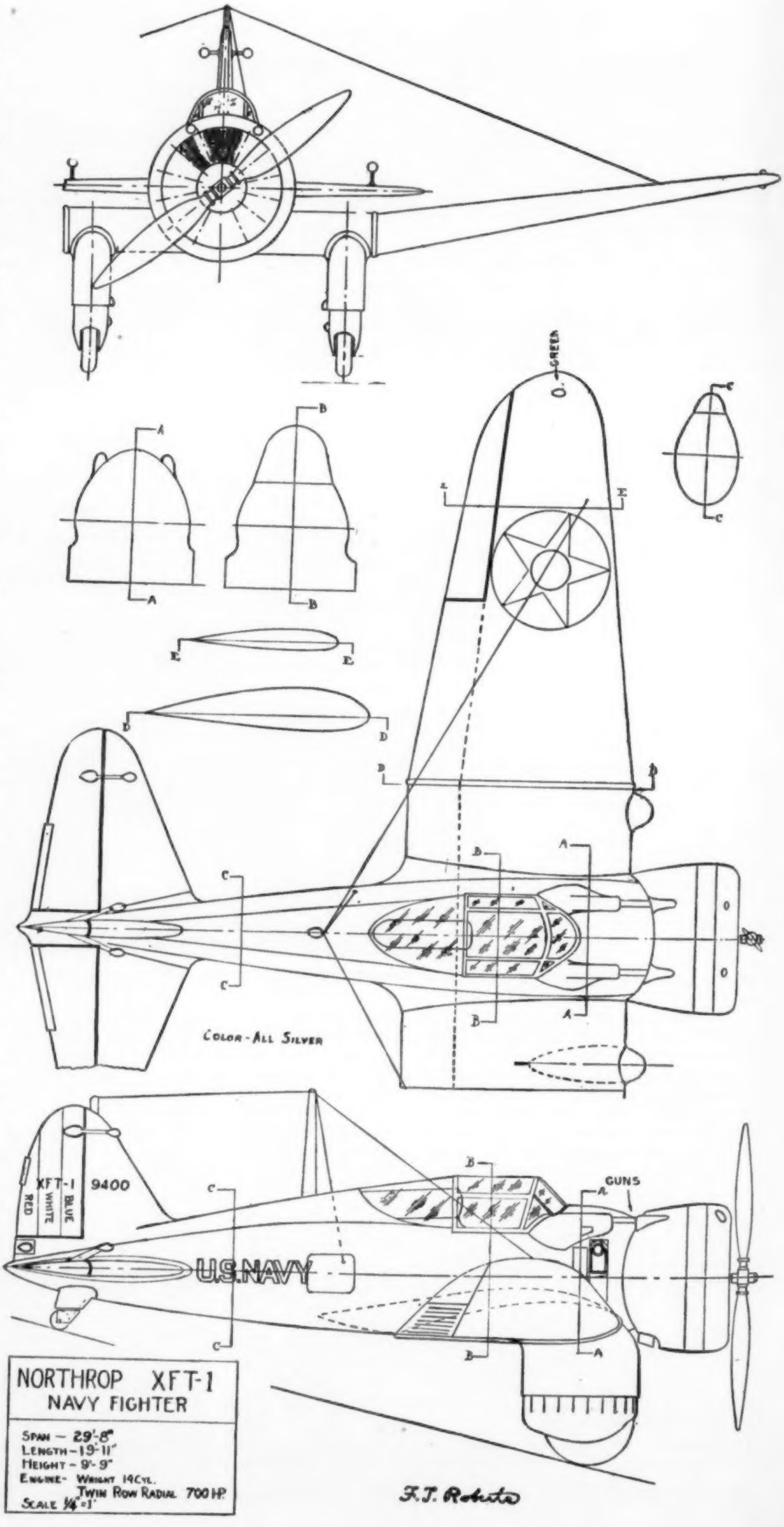
The Navy Curtiss seaplane racer C-R-3, which won the Schneider Cup Race in 1923, marked an improvement in gas tank location by placing them in floats. This plane carried 8-gallon auxiliary tanks in each float and attained a speed of 117 miles per hour.

Probably no racing plane in America is better known than the R3C-1, affectionately called the "Little Black Racer" and "Old 43." This plane won both the Schneider Cup Race and the Pulitzer Race in 1925 and could reach a speed of 250 miles per hour.

Several technical improvements are significant. The plane demonstrated the greater efficiency of the forged duralumin propeller, such as is in general use today, over the twisted duralumin type. It also had an improved wing curve, being the most efficient racing airfoil yet designed. The wing radiators were made of brass sheeting thinner than eggshell and the special bronze used in the construction of the plane had a tensile strength of 105,000 pounds per square inch (ordinary bronze has a tensile strength of 60,000). The cockpit was so constructed that in an emergency the pilot could with one movement rip it open and jump with his parachute. Another important feature was the skin-type radiators attached to the front of the floats when the ship was rigged as a seaplane. It was powered with a 700-horse-power Curtiss V-1400 engine.

One of the most important developments of all time in aviation was made in a standard Navy Curtiss *Hawk*, type F7C, in the Curtiss Marine Trophy Race of 1929—streamlining for an air-cooled engine. This was an unheard-of thing at that time. It was

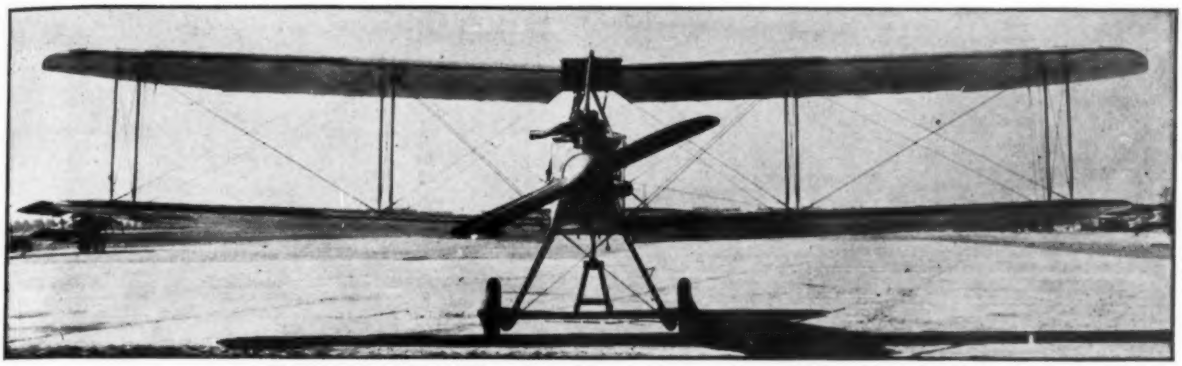
(Continued on page 48)



NORTHROP XFT-1
NAVY FIGHTER

SPAN – 29'-8"
LENGTH – 19'-11"
HEIGHT – 9'-9"
ENGINE – WRIGHT 14 CYL. TWIN ROW RADIAL 700 HP.
SCALE 1/4"=1'

F. T. Roberto



The Albatros J-1, powered with a 200 h.p. Benz motor (1917). It looks like the DH-4

The Albatros Fighters on Parade

Details of Rare Albatros Types Developed in the Last Year of the War and How They Compared with Other Fighting Planes

By JOSEPH NIETO

REGARDLESS of the success attained after that period in which the Albatros D-7, D-9, D-10, and D-11 experimentals had proved satisfactory in tests, the Albatros-Werke, for reasons explained later in this chapter, turned back in their forms of "D" type construction to the earlier developments of 1917.

The D-X1, succeeding the lightplane series with the character of a "superfine sport-type," was a success as far as an experiment went, but in spite of any discrediting classification given this obscure ship, it could hardly be considered a failure in comparing its performance with other outstanding single seaters of that time. However, the Albatros-Werke brushed its hands with the completion of that experimental series of lightplanes and got down to work on something that could manifest itself more along the order of the earlier D-5a, which machine even at this stage of the war was still making great aerial history.

Experiments which had been carried on so intensively in developing preceding types since the D-7 became more intensive in the creation of a successor to the D-11. Strangely enough, two of these were built which carried the same "service tag" of Albatros D-12.

The first of these was the L-42 which came out in March 1918. As will be observed in the photograph of this machine, the L-42 conveyed some of the influence of the preceding lightplane construction, and with the back-track employment of the old 160 h.p. Mercedes engine instead of the previously used 195 h.p. Benz, the L-42, D-12 was yet lighter and possessed of finer fighting characteristics than the 1917 D-7.

The fuselage which was practically of the same forms as the D-10 and D-11, consisted of six main body sections mounted on four longitudinals of wood to form the rectangular effect of its flat sides and bottom. The upper curved parts of the body were substantiated with two additional curved sections mounted on the upper longitudinals, dividing in approximate thirds the distance between each of the six main body sections.

As a whole, they made up a very substantial construction which although of practically the same forms as the bodies of the D-9, D-10 and D-11, the fuselage of the L-42 was comparatively more practical than any heretofore designed in this line. As usual, the fuselage of this machine was covered throughout with 3-ply wood veneer except for the metal cowling, which was attached around the engine displacement protecting the plywood covering nearest that section.

This particular plating was similar to the forms of the D-5a and Dr-1 and was fastened by its overlapping edges to the upper body longitudinals on each side. The tip of the nose was of the same metal cupping first brought out in the D-9. Inspection plates were provided, one on each side of the engine plating, and two also of metal set into each of the plywood sides of the nose. Between these inspection covers, only one metal air vent was used. An additional cover of the same circular shape was provided on the left side of the body permitting external approach to the fuel line connecting at the throttle. A diminutive spinner was connected to the hub of the conventional "Axial" propeller used in most of the preceding types.

The wing construction of the L-42 was characteristic of the earlier D-5a and D-7 models and possessed of approximately the same dimensions as the D-5a with the exception of the lower wing which, in the L-42, contained about the same chord length as that of the main plane.

The upper wing of this machine with about 30 speed-type ribs mounted on two main spars, constituted a span of approximately 30 feet including the counterbalances of the ailerons which were featured in this type.

The Teves & Braun surface cooler, as in earlier models, was set in the right half of the mid-wing section.

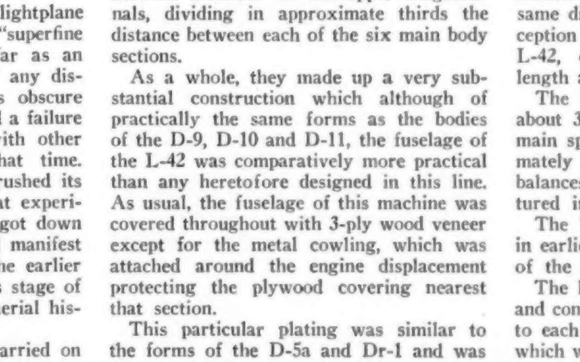
The lower wing was made up in halves and consisted of about 14 speed-section ribs to each half, mounted on two main spars, which when attached to the body comprised a total span of approximately 29 feet and 2 inches.

The chord length of both planes was approximately 5 feet.

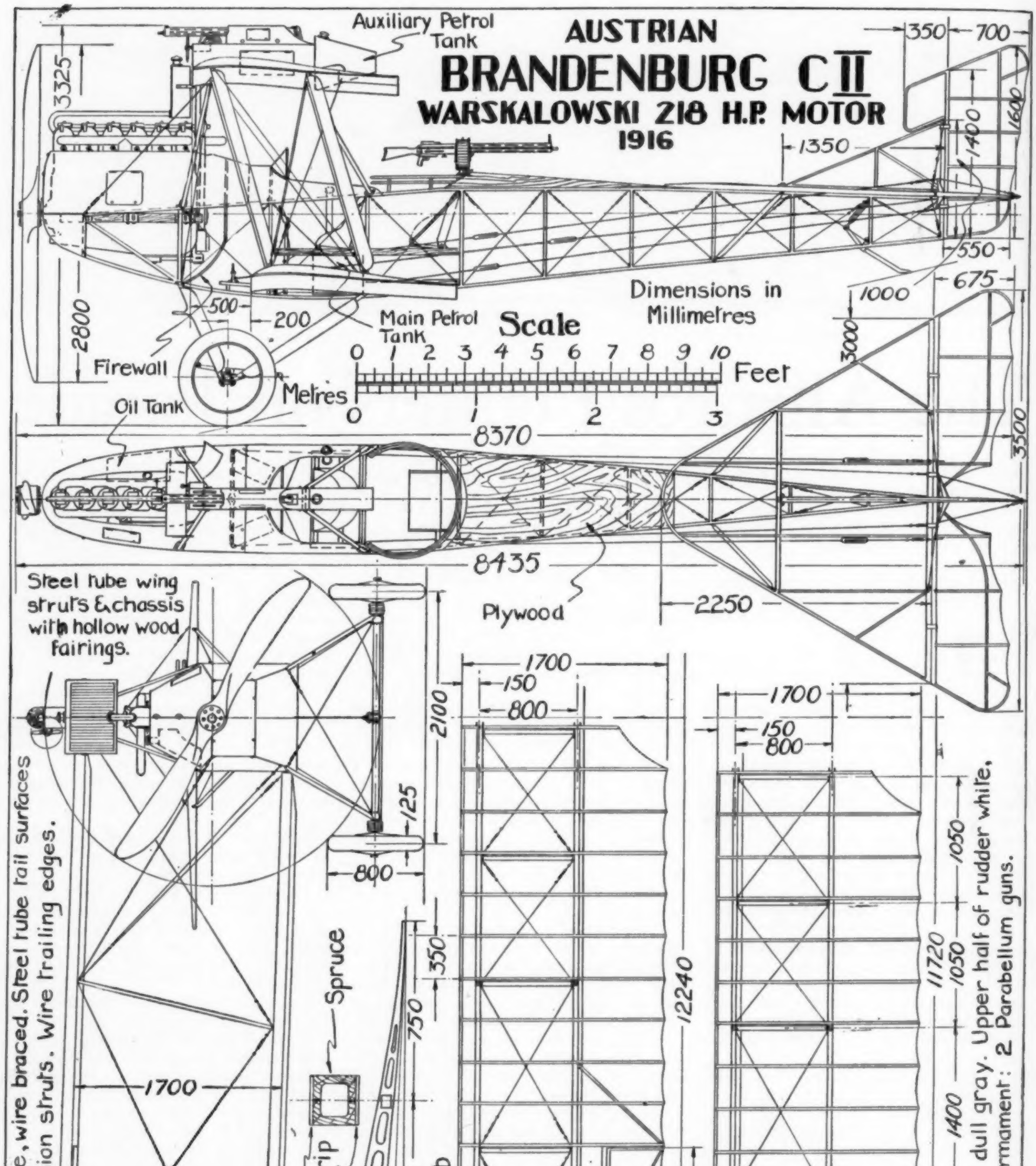
Disregarding the characteristic scallop effect usually noted in most of the earlier Albatros models, the trailing edges of the L-42 wings were straight, thus presenting a more modern cut over previous forms. The only two ailerons employed in the upper wing of this machine were counterbalanced at their tips and swung on an internal axis which was borne by an auxiliary spar within the wing structure.

In this instance, unlike the forms carried out in the wings of preceding models, the outer direction to the widest parts of the ailerons was diverted inward toward the leading edge of the upper wing, giving the entire structure of both planes a corresponding parallel throughout.

Exposed cables controlling the ailerons were axiated by



The trim D-12 (L-42) mounting a 200 h. p. Mercedes engine. The 160 h.p. Mercedes was standard equipment


AUSTRIAN
BRANDENBURG CII
WARSKALOWSKI 218 H.P. MOTOR
1916
Auxiliary Petrol Tank
Main Petrol Tank
Firewall
Oil Tank
Dimensions in Millimetres
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0 1 2 3 Metres
3325
2800
500
200
350
700
1600
1400
1350
550
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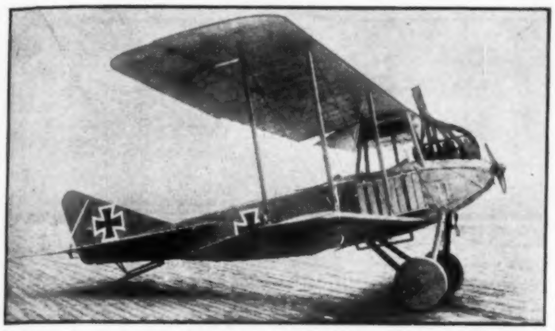
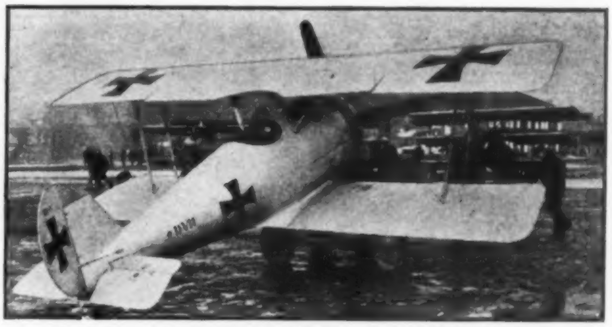
3000
3500
8370
8435
Plywood
2250
Steel tube wing struts & chassis with hollow wood fairings.
2100
125
800
1700
150
800
1700
150
800
12240
11720
1050
1050
1400
1400
2540
500
350
750
800
150
Spruce
Ash Strip
Spruce
Wing Rib
2°
2°
Steel tube fuselage, wire braced. Steel tube tail surfaces and wing compression struts. Wire trailing edges.
Color scheme: All dull gray. Upper half of rudder white, lower half black. Armament: 2 Parabellum guns.
John E. Roe/35



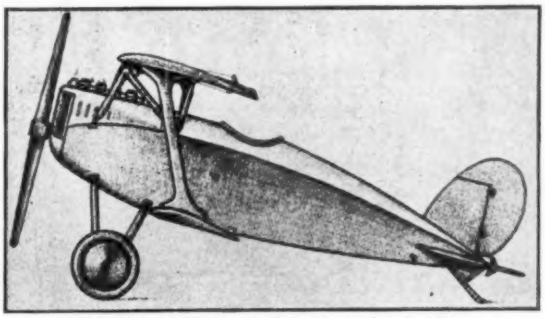
The Albatros B-2 with a Mercedes 100 to 120 h.p. (1915) One of the first effective fighters



The Pfalz D-7. Note the wing fillets and streamlining. Today we think such features modern

spindles which were enclosed one within each of the lower wing halves just behind the lower connecting points of the rearmost interplane struts. At these points of connection to the control rod spindles, the cables moved simultaneously through two holes provided in a streamlined metal shell that covered the joint mechanism of each of the spindles.

The interplane struts consisted of only one pair of wood, on each side supporting the wing structure in contact with the main spars of both planes similar to the arrangement of the earlier D-7. The N struts connecting the mid-wing section to the body of this machine, presented slight changes over previous forms. The foremost connecting points of the N were attached at the upper ends to the front spar of the upper wing, while the lower ends joined to the upper body longitudinals. The V forms of these struts however, were connected at their joints to an additional longitudinal member which was especially provided on each side of the body along the line of thrust approximately 4 feet back of the tip of the nose.



The D-13 with a 160 h.p. Mercedes (1918)

To finish up the bracing of both planes, only one set of circular stranded guy cables was used on each side. These were connected to the main spars of the upper wing near the interplane strut ends and joined down to a U type double turnbuckle, which in turn connected to the lower body longitudinals just aft of the leading edges of the lower wing halves. The paired interplane struts were likewise braced with two circular stranded cables that crossed diagonally from all four points of connection at the wings. It is especially pointed out, disregarding what has been said against the wing structure of the Albatros as a characteristic exemplified by the earlier D-3, that the sturdy wing structure of the D-12 would enable this machine to bear up under great strain in case its guy cables were shot away.

The tail was similar to that of the D-10 and D-11 but for the exception of the "stock" that controlled the elevator. These were the control cables which were exposed and emerged from each side of the body about 5 feet back of the cockpit, connecting to two unique steel-frame control horns governing the movement of the elevator, which, like the D-5a, was a counter-balanced 1-piece type.

The vertical fin which was covered with plywood veneer was integral with the body, while the rudder controlled by cables enclosed within the body, was fabric covered, likewise the horizontal fin and elevator. The small vertical fin attached to the body under the tail was reduced in depth to approximately 10 inches. The tail skid itself connected along its middle to the base of this fin, axiating from this point with the allowance of a shock absorber enclosed within the body connected to the upper end of the skid.

The landing gear was the same as previously used in the D-5a and D-7 except for the narrow axle-wing which was left out of this type.

The armament consisted of the usual pair of synchronized Spandaus placed immediately ahead of the cockpit on each side of the engine.

The L-42 carried a fuel supply of 54 liters in the main tank, 27 liters in the auxiliary (approximately 21 gallons) and 34 liters of oil, sufficient for little over one hour of flight.

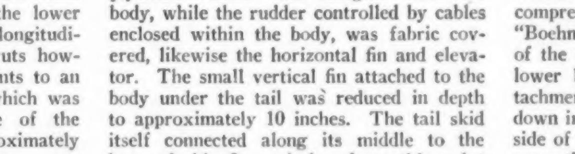
In experiments at the Albatros-Werke prior to its presentation before Imperial Air Force officials at the Johannisthal airdrome, the L-42 was listed with a speed of over 200 kilometers per hour (approximately 125 m.p.h.) and a climb of 8,000 meters (approximately 27,000 feet) in 40 minutes with a 160 h.p. Mercedes engine. This machine was later tried out with the 200 h.p. Mercedes but details regarding the result of that experiment are unavailable to the author.

The L-43, also identified as the Albatros D-12, came out in April of that year. It was the same as the L-42 with the exception of its unusual undercarriage which was a 6-strut type. Owing to the use of compressed air shock absorbers of the "Boehm" type, a third strut on each side of the undercarriage was connected to the lower body longitudinals between the attachments of the first two, all three joining down in fan method to the Boehms on each side of the axle. The wheel measurements were the same as those of the D-11, the track, however, was spread out to 1951 millimeters (approximately 6¼ feet) making this machine slightly shorter in height than the preceding L-42.

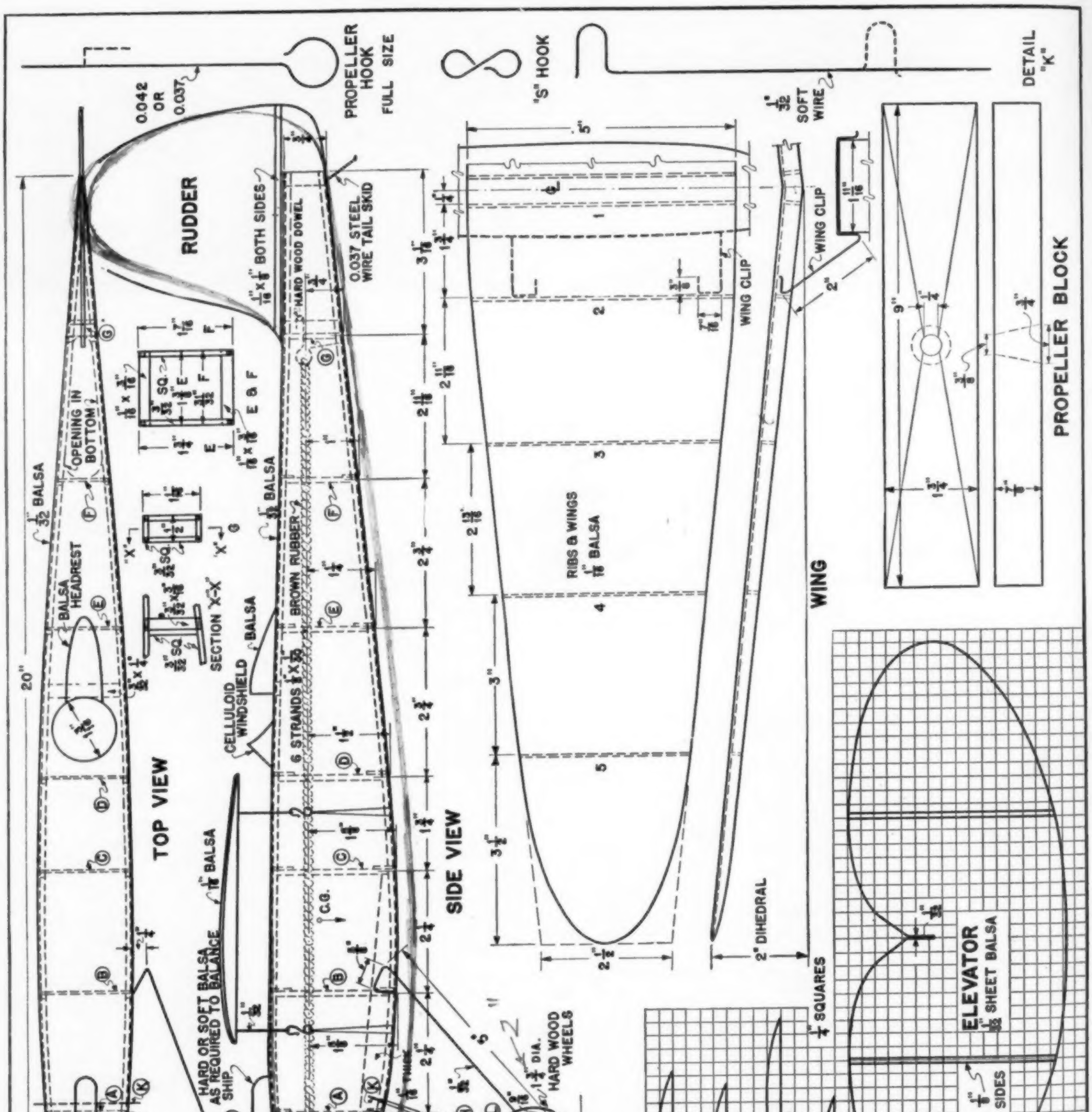
The L-43 was originally equipped with a 200 h.p. Benz 3a. Later it was replaced by the 160 Mercedes probably to determine its possibilities with an engine of this type. Every other detail was practically the same as the L-42. The spinner, however, a minor detail in this instance, was last used in the previous type.

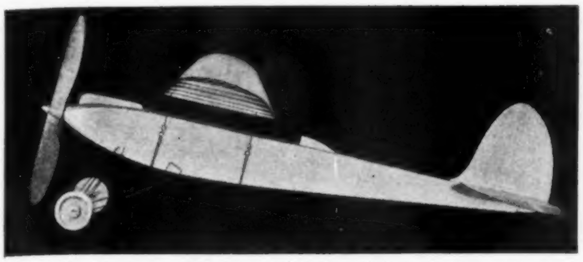
Toward the end of productive activities in the military line of the Albatros-Werke, experiments were carried on with two other types which turned out to be the final developments in the Albatros "D" type series. The Albatros D-13, produced along in the summer of 1918 under the serial or firm name L-44, conveyed much of the influence possibly derived from the first single-seater built under the Albatros trade-mark before the advent of the D-1. This natty little scout carried the German Imperial Air Service insignia over the front lines back in 1915, when the black

(Continued on page 37)

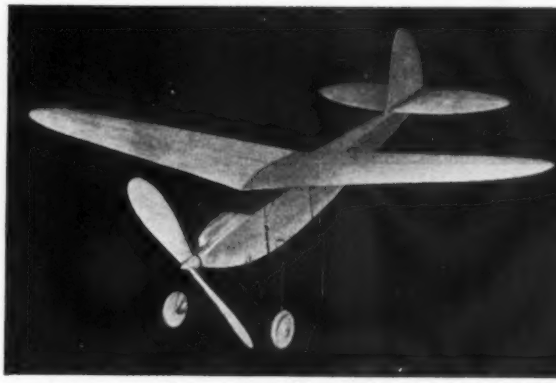


The D-14 (L-46) with a 180 h.p. (B.M.W.) engine, the last Albatros type built (1918)


TOP VIEW
SIDE VIEW
FRONT VIEW
RUDDER
WING
ELEVATOR
PROPELLER BLOCK
PROPELLER HOOK FULL SIZE
0.042 OR 0.037
"S" HOOK
END HOOK
DETAIL "K"
SOFT WIRE
WING CLIP
RIBS & WINGS
BALSA
BALSA HEADREST
OPENING IN BOTTOM
CELLULOID WINDSHIELD
6 STRANDS
BROWN RUBBER
HARD WOOD DOWEL
0.037 STEEL WIRE TAIL SKID
BOTH SIDES
SECTION "X-X"
HARD OR SOFT BALSA AS REQUIRED TO BALANCE SHIP
HARD WOOD WHEELS
TRAP DOOR
TAPE HINGE
RUBBER
ELEVATOR
C.G.
2" DIHEDRAL
SQUARES
SHEET BALSA
20"
5"
9"



Although this is an all-balsa model, it weighs only 2 ounces and is capable of 800 foot flights



It is very realistic and stable in flight. Span 26 inches

Fundamentals of Model Airplane Building

How You Can Build an Experimental All-Balsa Built-up Fuselage Monoplane Capable of Long Flights—Part No. 12

By GILBERT MacLEAN

WHAT a fascinating and instructive pastime model airplane building is! Fans who have recently become interested in it and have followed the course of instruction given in these articles, have spent, undoubtedly, many pleasant hours building and flying the planes which have been presented. The purpose of the course has been to instruct the beginner in the fundamental phases of model plane construction. The first plane presented was of the very simplest type, well within the capacity of the novice to complete and fly successfully. Each succeeding plane embodied in its construction new operations which would gradually advance the building experience of the model fan who was interested enough in aviation to construct each plane as it was presented.

Here is a model to build this month which embodies many of the "old" operations and a few new ones. A new type of fuselage affords practice in built-up fuselage construction without the complication of paper covering and the landing gear is of different design than those which have appeared on previous ships.

Before we tell you how to proceed with its construction, probably you will be interested in hearing about its performance.

The model weighs only 2 ounces, although it has a wing span of 28 inches and is of "all-balsa" construction with no paper covering. Because of its lightness it will fly on only six strands of 1/8x1/30 rubber. (Preferably brown rubber lubricated.) This amount of power gives it a quick R.O.G. take off and a fast climb. Fully wound it has flown 800 feet and has climbed to an altitude of 100 feet. Without question greater altitude can be attained under perfect conditions. It is a remarkably steady and stable flyer as well. Flights of 60 seconds have been made with it when the motor was lubricated and wound with a winder.

Now you can begin construction, provided you have listed and purchased the amount of material required.

Fuselage

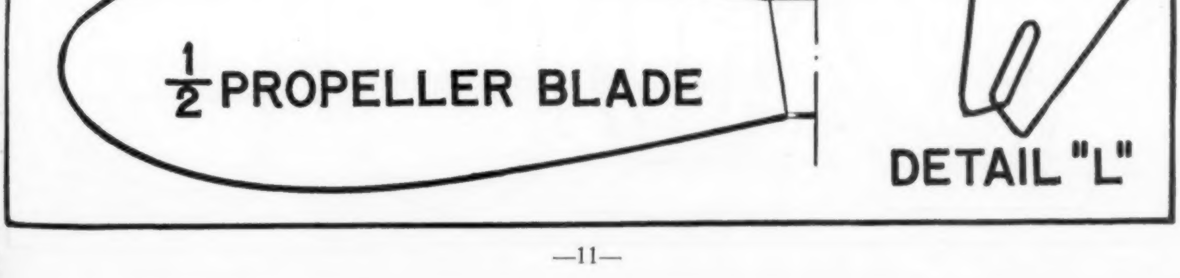
Start your work by constructing the fuselage. The two sides are laid out according to the dimensions given on the bulkheads in the drawing and cut from 1/32" sheet balsa (light weight grade). The front edge of the side strips is at J in the drawing. Along the inner edges of these sheets are cemented the stringers of 3/32" square balsa, as shown in the drawing. Their front ends are 3/8" from the front edges of the side sheets. Next the reinforcing strips K are cemented in place to the sides, just over the lower longerons, their front ends being located 7/8" from the front edges of the body side pieces. You can now cement the vertical struts, A, B, C, D, E, F, and G in their proper places. A and B are cut out at their lower ends so they can fit over the strips K. Cement all the joints well.

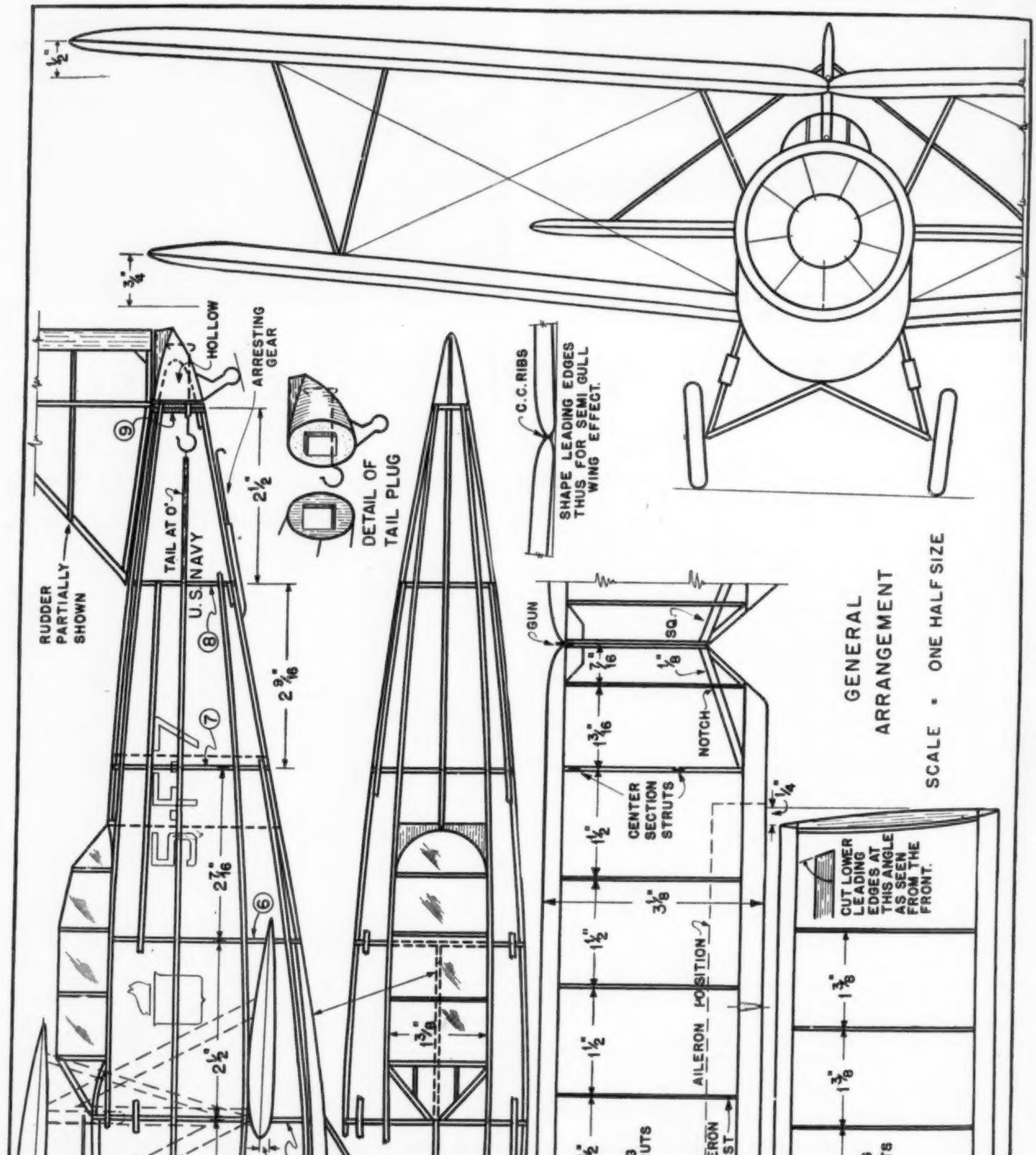
The nose block is cut out next from a block of medium-weight balsa, 1½" long, 1 3/16" wide and 1½" high. On the front end of the block, mark a point 9/16" from the top and half way between the sides. This is the point at which the shaft passes through it. With this point as a center, draw a circle ¾" in *diameter*. Now cut the four sides of the block so that they curve into this circle. Keep the sides flat. Do not round the edges or corners until after the body is finished. The four sides of the block should form a square around, and the sides touching the circle. (See side view of drawing.)

Next hollow out the rear end of the block, as shown by the dotted lines in side and top view.

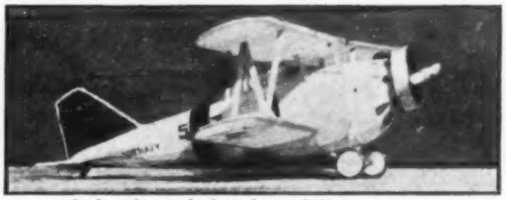
When the sides and block are finished, cement the front ends of the sides to the block as shown, the front edges of the sides being 7/8" back of the front face of the nose block. Cut out the corners of the block so the longerons on the sides fit into the block. Be sure the sides are parallel to each other vertically so they will meet perfectly at the rear when they are pulled together. Hold the sides in place on the block by wrapping rubber bands

(Continued on page 34)




GENERAL ARRANGEMENT
SCALE - ONE HALF SIZE
PLATE No. 1
RUDDER PARTIALLY SHOWN
TAIL AT 0°
U.S. NAVY
HOLLOW
ARRESTING GEAR
DETAIL OF TAIL PLUG
C.C. RIBS
SHAPE LEADING EDGES THUS FOR SEMI GULL WING EFFECT.
GUN
SQ.
NOTCH
CENTER SECTION STRUTS
AILERON POSITION
AILERON POST
WING STRUTS
CUT LOWER LEADING EDGES AT THIS ANGLE AS SEEN FROM THE FRONT.

Unlike some flying models, it looks like the large plane



It has been designed carefully to scale

Building the Grumman Fighter

How You Can Construct a Remarkable Flying Scale Model of the Grumman Shipboard Fighter FF-1

By LAWRENCE McCREADY

BY building this flying scale Grumman fighter, you will have a model of one of the Navy's latest and best shipboard scouts. With a Wright Cyclone, these ships combine a high speed of 215 m.p.h. with extraordinary maneuverability. They are as rugged as they look and so is the model.

Fuselage

Begin your model with the fuselage. Transfer the patterns of the formers, given on drawing No. 3, to 1/16" thick medium balsa. Cut them out very accurately with a sharp, pointed razor blade. Glue a reinforcing strip to No. 5 as shown. Glue 1 and 2 together with the grains at right angles and bevel the edges off to the angle shown in their side view. Cut two of No. 9 and glue them together also with grains at right angles; this last former must be of hard balsa. Now notch all the formers for 1/16" sq. stringers—get the locations for these notches accurate. Cut out stringpieces A (1), B (2) and C (1), and mark the positions of the formers on them.

Start the assembly of the fuselage by marking with soft pencil the positions of all the formers on the two side stringers which follow the center line on the plan. Glue the formers, starting with the largest ones and working toward the ends, to these side stringers. Work slowly and accurately here. Then glue in the large bottom stringpiece A and follow it with pieces B and C. Watch the alignment here. Now put in the top and bottom rear stringers and let the whole job dry hard before you go any further.

Now glue the rest of the stringers in slowly and well. Sand the whole fuselage over lightly to remove all the sharp edges and joints. This will give you a better covering job. Glue a soft balsa block lightly to the rear of the fuselage and shape it up as shown for the tail plug. Remove it, hollow it out, sand it and install the square plug and rear hook.

Engine and Drag Ring

Make the engine now. This model has a very realistic engine, which is easy to make. Cut the crankcase from fairly hard balsa and shape it up. Cut 9 cylinders from soft balsa, shape them uniformly and bevel each for the valve rocker box caps which are cut from 1/16" sheet wood. Glue the cylinders to the crankcase with plenty of glue, then cut and fit the 18 pushrods which are 1/32" bamboo. Glue a washer to the front and make a hole through the case for the shaft. Then glue a square plug to the rear. A 2½" drag ring ⅝" wide, either homemade or manufactured, is used. Glue it on after the whole motor has been painted a dull black. The ring may be made of either aluminum or balsa; both are shown in cross section on the plans. If you use a balsa ring, make it by bending a 8½x½x-1/16 piece of balsa around a tin can. Have the grain run along the *width* of the piece. Trim and sand the job up after everything is dry and glue it to the motor.

The little ship is an excellent flyer and very realistic in the air

Pilots' Enclosure

Make this now. Bend thin bamboo strips for the formers to the given cross sections and glue them to the stringers. Put in the rest of the framing and cover it with thin celluloid. Don't use cellophane—use an old negative which has been soaked in hot water and scraped clean on both sides with a razor blade.

Tail Surfaces

The elevators and stabilizer are framed in 1/16" sq. and the ribs are 1/16" flat, cut as shown. Cut the tips of 1/16" flat to the pattern and assemble the two halves. We use novel "flaps" on the trailing edges of the tail surfaces on this model for control, and they are made of 1/32" soft sheet balsa. The rudder is made almost entirely of 1/16" sq. balsa with a flap like those on the elevators.

Wing

The wings are simple to make and they are very strong. Cut 28 ribs of 1/32" balsa and 10 of 1/16" hard balsa with the aid of an aluminum pattern. Glue two of these hard, thick ribs to the fuselage sides to form stubs at the angle given on the drawings. Get the incidence just right. The wing section is the M-6 and is very fine for models.

Select clear, medium balsa for your leading edges, which are ¼" sq. Cut the edges to the correct length and shape them to the given cross section with razor, plane and sandpaper. Slot the ends for the wing tips, then shape the ends off to a rounded taper. The inner ends of the lower spars are beveled at an angle which is shown on No. 1 plainly.

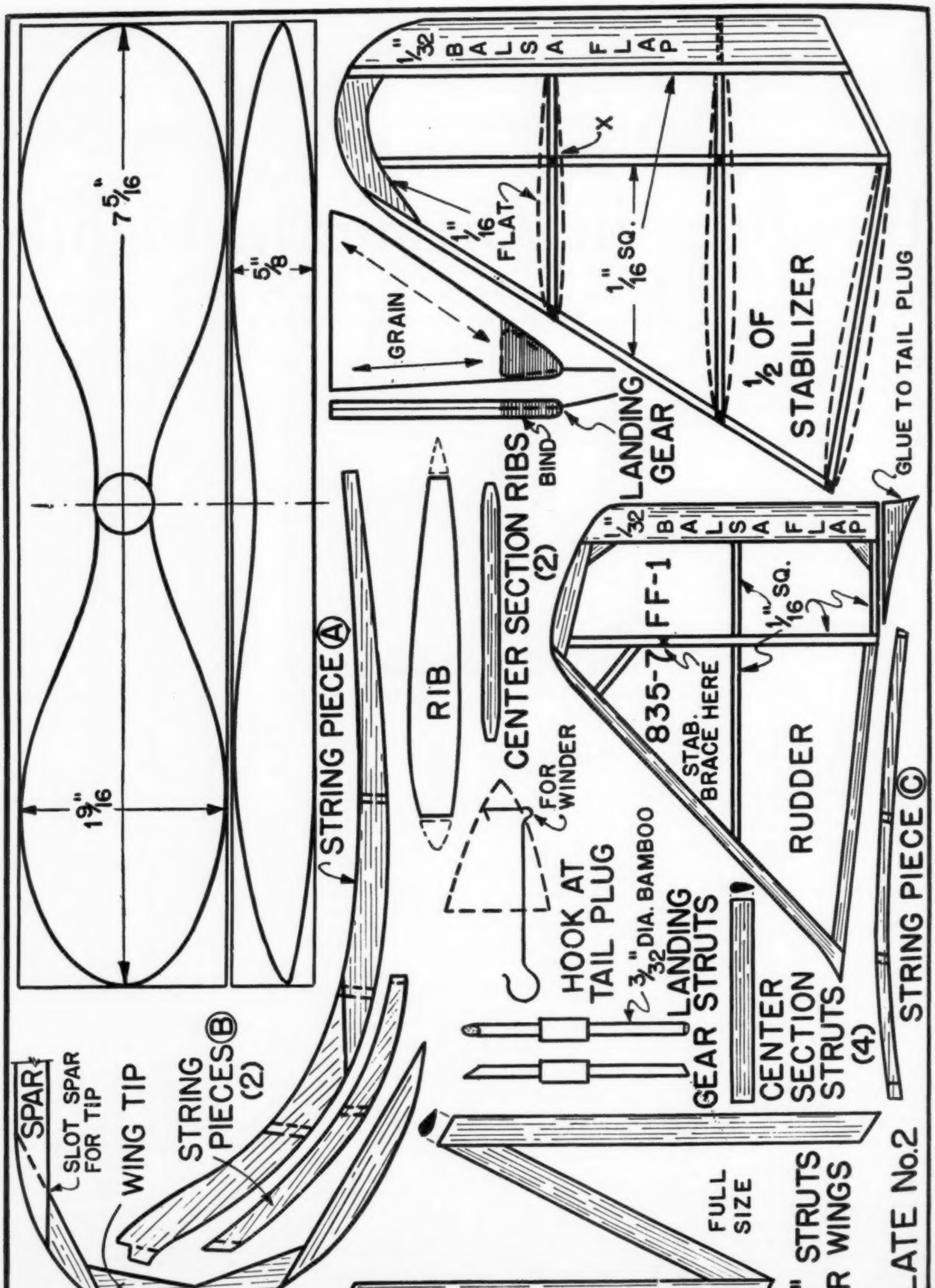
Trailing edges are of ⅛x⅜ balsa cut to a modified triangular section. Mark both leading and trailing edges carefully for rib positions and assemble the wing frames. *Make sure you have the heavy ribs where the struts are attached.* Note the semi-gull-wing effect of the upper wing and the two special inner center-section ribs there. Cut the wing tip pieces from the patterns, glue them up and then fit them to the wings. Put in the upper center-section framing, paying heed to the ⅛" sq. diagonals. These are important for they take the loads when the wings strike an obstacle and tend to fold back.

Note how the inner ribs of the lower wings are fitted at an angle. This is done so they will fit closely to the fuselage, and if your fuselage is a bit "out" here, you will have to rearrange this to suit your model. When everything has dried hard, you should trim up all the joints and sand everything smoothly so you will get a better covering job.

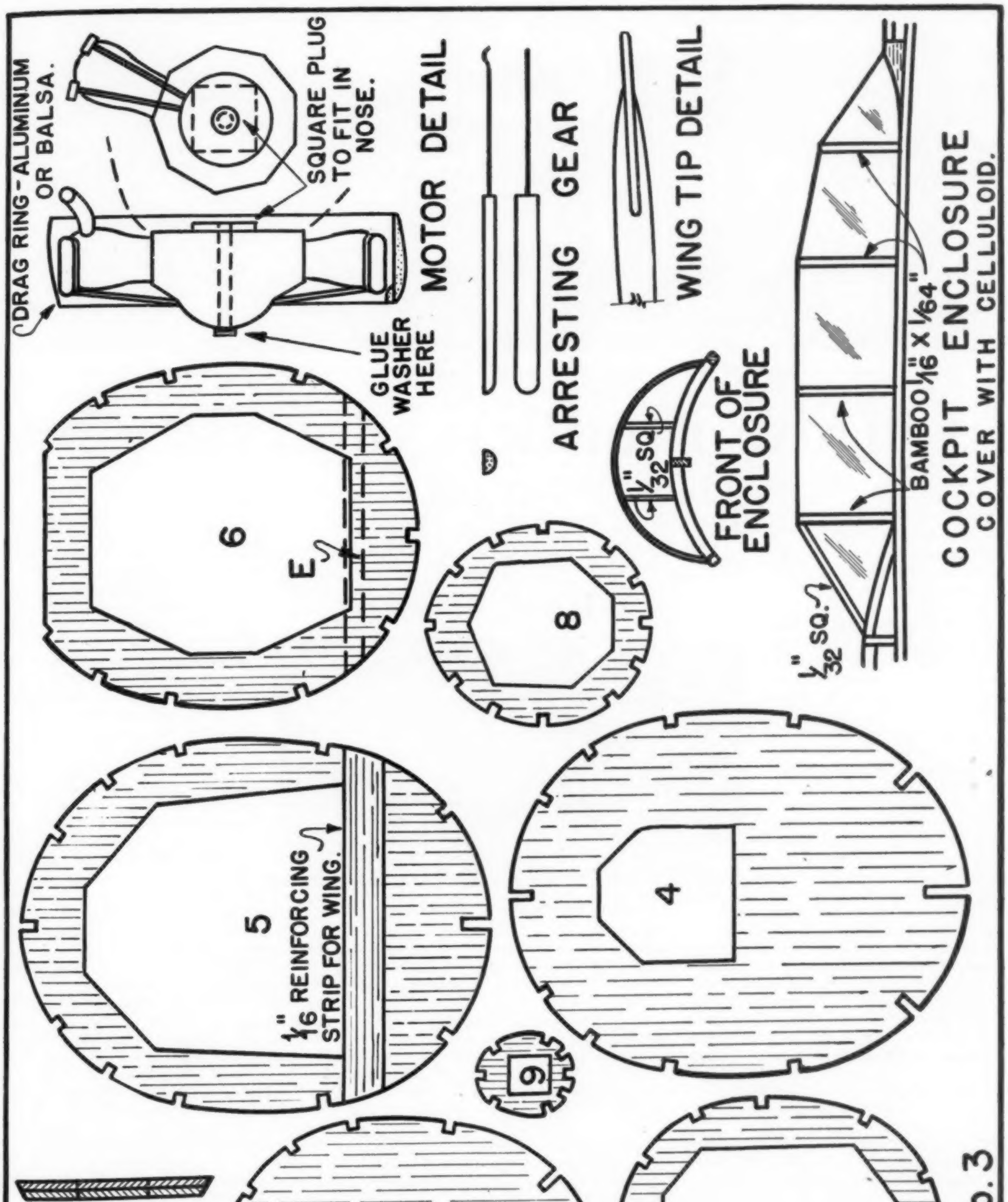
Landing Gear

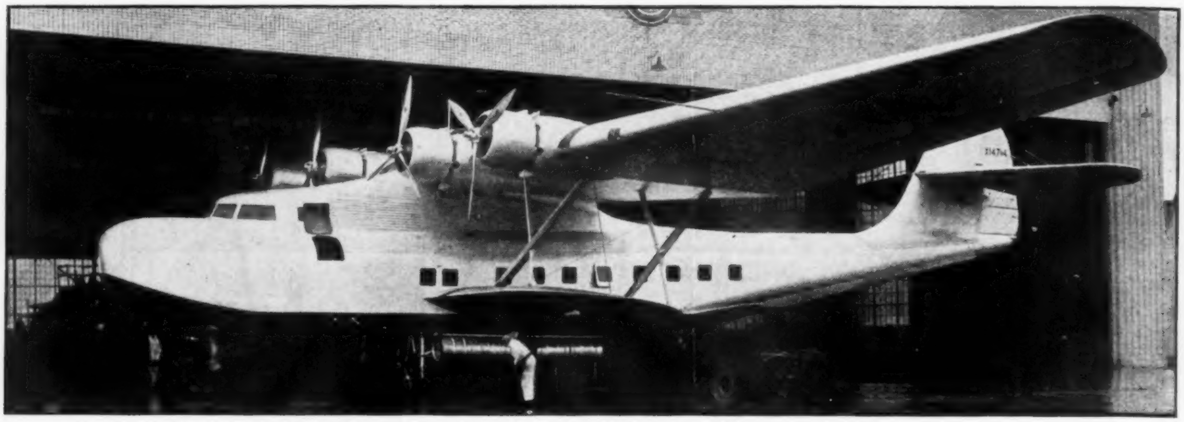
The gear on this model does not retract as does the large one, but the model is very realistic just the same. Make up the two "legs" of cross-grained balsa sheet—hard balsa—and glue them together with the axle sandwiched in between. Shape the legs to a general streamline shape, and then bind the tip by the axle with thread. Dope and sand the pieces now. The shock struts are clearly shown in the plans and are made of round bamboo with round dummy "oleo" shock units glued on.

(Continued on page 36)



7 5/16"
1 9/16"
5/8"
SPAR
SLOT SPAR FOR TIP
WING TIP
STRING PIECES (B) (2)
STRING PIECE (A)
RIB
CENTER SECTION RIBS (2)
BIND
LANDING GEAR
GRAIN
1/16" FLAT
1/16" SQ.
X
1/32" BALSA FLAP
1/2 OF STABILIZER
GLUE TO TAIL PLUG
FF-1
835-7
STAB. BRACE HERE
RUDDER
FOR WINDER
HOOK AT TAIL PLUG
3/32" DIA. BAMBOO
LANDING GEAR STRUTS
CENTER SECTION STRUTS (4)
STRING PIECE (C)
FULL SIZE
"N" STRUTS FOR WINGS
PLATE No. 2


DRAG RING - ALUMINUM OR BALSA.
SQUARE PLUG TO FIT IN NOSE.
GLUE WASHER HERE
MOTOR DETAIL
ARRESTING GEAR
WING TIP DETAIL
FRONT OF ENCLOSURE
1/32" SQ.
BAMBOO 1/16" X 1/64"
COCKPIT ENCLOSURE
COVER WITH CELLULOID.
1/32" SQ.
6
E
8
5
1/16" REINFORCING STRIP FOR WING.
4
9
1&2
3
7
PLATE No. 3



The new Martin Clipper Ship No. 7 with a wingspread of 130 feet and room for 46 passengers

On the Frontiers of Aviation

High Lights of New U.S. Army Planes—Progress in Commercial Plane Design—Building a Scale Model of the New Martin Clipper Ship

By ROBERT C. MORRISON

JUDGING from the orders sent to the various aircraft companies for more military planes, it seems that we are soon to have an air force with equipment far superior to any other country in the world. Following is a list of the planes that have been ordered for the Army Air Corps in 1935: 110 Northrop Attacks; 50 Consolidated Pursuits; 71 Douglas Observation Planes; 35 Seversky Basic Training Planes, and 81 Martin Bombers, making a total of 347 planes ordered.

The Northrop Attack is a low-wing, all-metal 2-place monoplane similar to the first Northrop Attack built for the Army last year and which is now undergoing tests by the Royal Air Force in England. The order for the 110 planes totals $1,896,400. A semi-retractable landing gear is incorporated in the design of the swift attack plane. Undoubtedly it is similar to the landing gear on the new Cunningham-Hall described later in this article. Top speed is said to be 215 m.p.h. There have been reports that the plane will do 260 m.p.h., but this hardly seems possible for such a large plane with only one 715 hp. Wright "Cyclone" engine.

The Consolidated Pursuits, whose order amounted to $1,996,700, are of a modified version of the Consolidated P-30 described in the December issue of MODEL AIRPLANE NEWS. It will be a 2-place pursuit and it is said to be able to do 252 m.p.h.

The prow of the sea monster under construction

The Douglas order amounts to $1,655,-394 for the twin Wasp-powered high-wing monoplanes. These planes have a top speed of 230 m.p.h. and are designated XO-46. The accompanying photo reveals the swift lines of the new plane.

The new Seversky training planes are to be landplanes almost identical to Major de Seversky's record-breaking low-wing (see M.A.N. Nov. issue). A 340 hp. engine will be the power plant, of Wright Whirlwind make. Further news and photos of the plane will be published in this magazine next month. The thirty-five planes have been purchased for $745,738.

The Navy has purchased three Douglas air liners of the DC-2 type which are designated R2D-1.

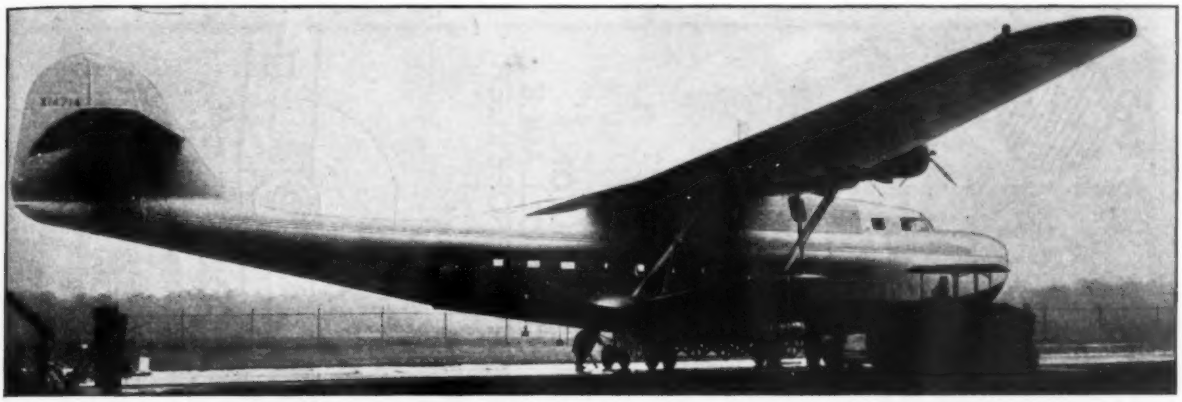
The Chance Vought Corporation has also been presented with an order for 84 scout-bombers from the Navy. The planes, known as the Vought SU-4s, have a top speed of about 200 m.p.h. The power plant is a twin-row Wasp, Jr. of 700 hp. Wing flaps are incorporated in the design which allows for a smaller wing area. In other respects the plane is quite similar to other Vought Corsairs now in naval service.

Mac Short, vice president and chief engineer of the Stearman Aircraft Company, is now busily engaged building 41 training planes for the Navy. The ships are 2-place biplanes with the various Stearman characteristics.

The first of the new giant Douglas patrol boats, XP3D-1, has been completed and is now ready for tests. The flying boats will be similar to the amphibian being built for the Army and P.A.A. (see p. 46, M.A.N. Sept.). The amphibian is known as the Senior Amphibian, YO-A5.

The Gamma 2-G, Miss Cochran's Conqueror-powered ship, now equipped with a Cyclone 710

The Douglas R.2 D-1, Navy transport with two 710 hp. Cyclones. (By McLarren)



Four engines of 800 hp. each drive this 23,100 lb. craft at a high speed of about 170 m.p.h.

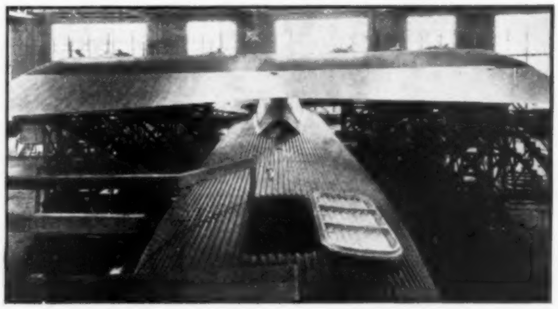
Its two Wright Cyclones are mounted on a strut system of airfoil profile and are variable to offset drag by a dead engine. This makes the ship easy to fly on a dead engine. The patrol boats are for the Navy and will be powered by P&W Twin Wasp Jrs. of 700 hp. each.

Another Douglas accomplishment is a new bomber! It has been developed from past experience with the Douglas DC-2 transports. It had been reported in an earlier issue of this paper that Anthony Fokker was also going to produce a bomber version of the DC-2. The two bombers will undoubtedly be identical. The wingspread will be 105 feet! Two gunners will be located in the nose of the plane; one operating a gun below the fuselage and the other one above. There will also be a gunner in the tail of the fuselage. The plane will be powered by two double-row engines and is expected to have a speed of 225 m.p.h.

A Douglas dive-bomber known as the XBD-1 is also being constructed for the Navy. The ship will be a single-engined, low-wing monoplane capable of a speed of 270 m.p.h. Landing gear is retractable. In a dive the plane is expected to reach a speed of 400 m.p.h!

The Navy has been testing a Douglas biplane known as the XFD-1 at Anacostia. This ship closely resembles the Curtiss Hawk. Its wings are tapered in the same manner as the Hawks and its fuselage is oval-shaped. There is an enclosed pilot and gunner cockpit on the swift-looking fighter. The tail units are very similar to those on the Northrop Pursuit, the elevators having control tabs on their trailing edges. No pants are employed on the landing gear, which is of the conventional 4-strut design with a straight axle joining both wheels. A radial engine almost fully cowled, supplies the power.

And still another Douglas! They are building a Navy bomber undoubtedly similar to the Army ship with a torpedo concealed inside the fuselage. Top speed will be about 200 m.p.h.



Looking forward along the body, from the tail

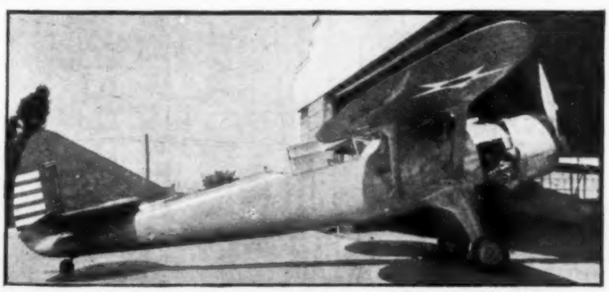
Seventy Douglas airliners have been completed and there are about 100 more on order. The Douglas factory is working overtime and still they are $8,000,000 behind orders!

The prosperous subsidiary of Douglas, the Northrop Corporation, has revamped their new, small Navy pursuit in order to obtain a higher performance. The plane, known as the XFT-1, has been returned to the factory from the Navy Experimental Station at Anacostia, D.C. A retractable landing gear has been built on the plane and the head rest has been faired into the fin. The ship will be returned to Anacostia for further tests under its new designation, XF2T-1. A double-row engine is the power plant. With such improvements on the ship, it is expected to reach a top speed of 300 m.p.h.

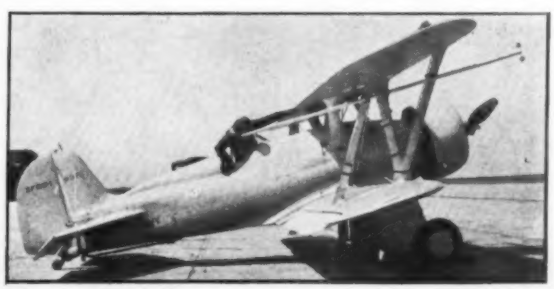
Because of the short life of Miss Jacqueline Cochran's plane, not much publicity has been given it. It was a very interesting plane and had one or two features which varied from the usual Northrop Gamma design. A liquid-cooled Curtiss-Wright Conqueror engine was the power plant. This made it possible for the plane to have a pointed nose as on our various Conqueror-powered military planes. The nose extended a considerable distance from the wing and gave the plane a very fast appearance. The two enclosed cockpits were situated in tandem fashion as far in the tail of the fuselage as possible, the rear cockpit almost being a part of the vertical fin. After the plane crashed, just prior to participating in the MacRobertson Race, it was sent back to the factory and rebuilt. A Wright Cyclone F-3 (710 hp.) was installed in place of the Conqueror and the cockpits were moved forward considerably. The rudder has been redesigned and other minor changes have been made. Accompanying this article is a photo of the remodeled plane.

Plans are now on the drafting boards

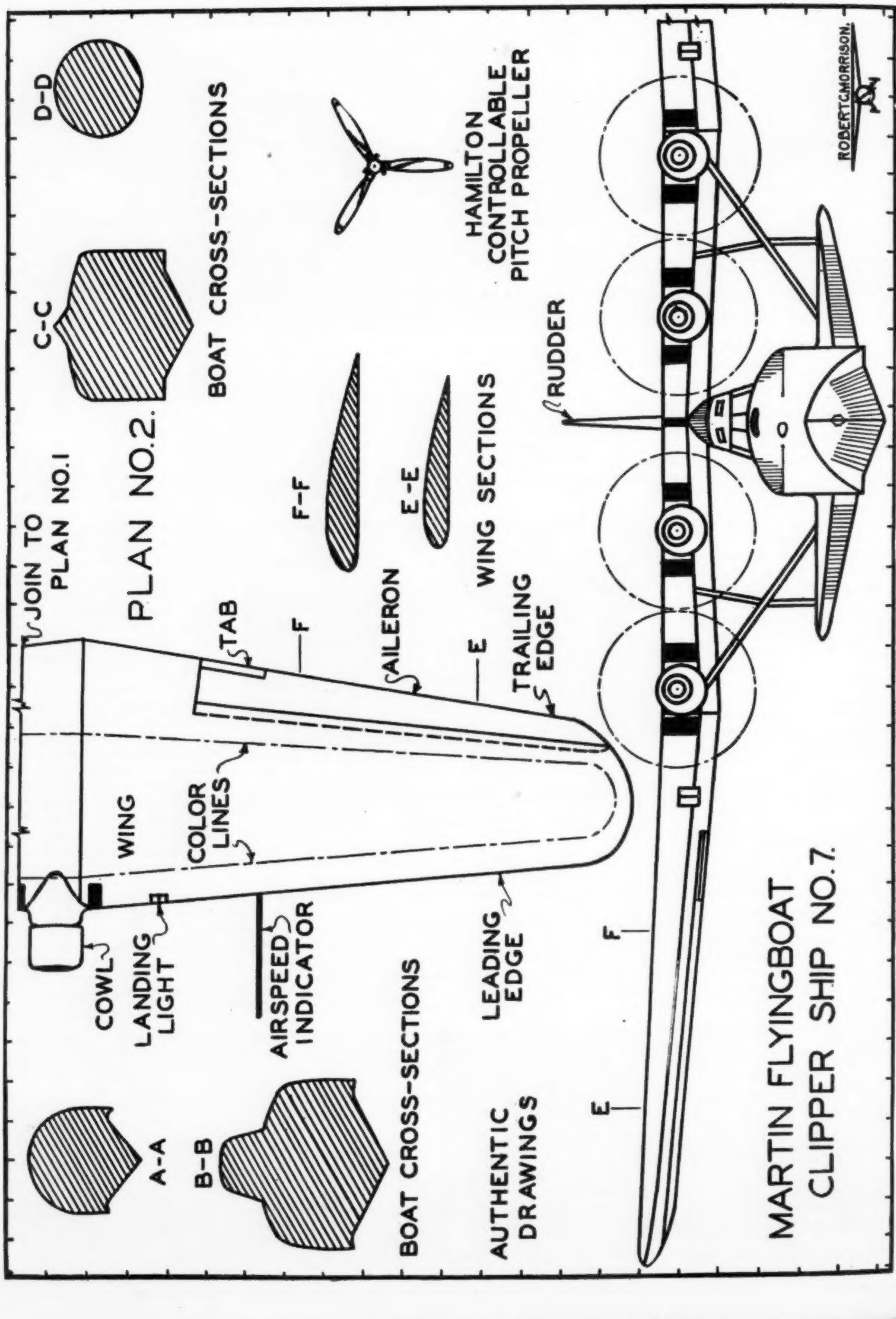
(Continued on page 43)

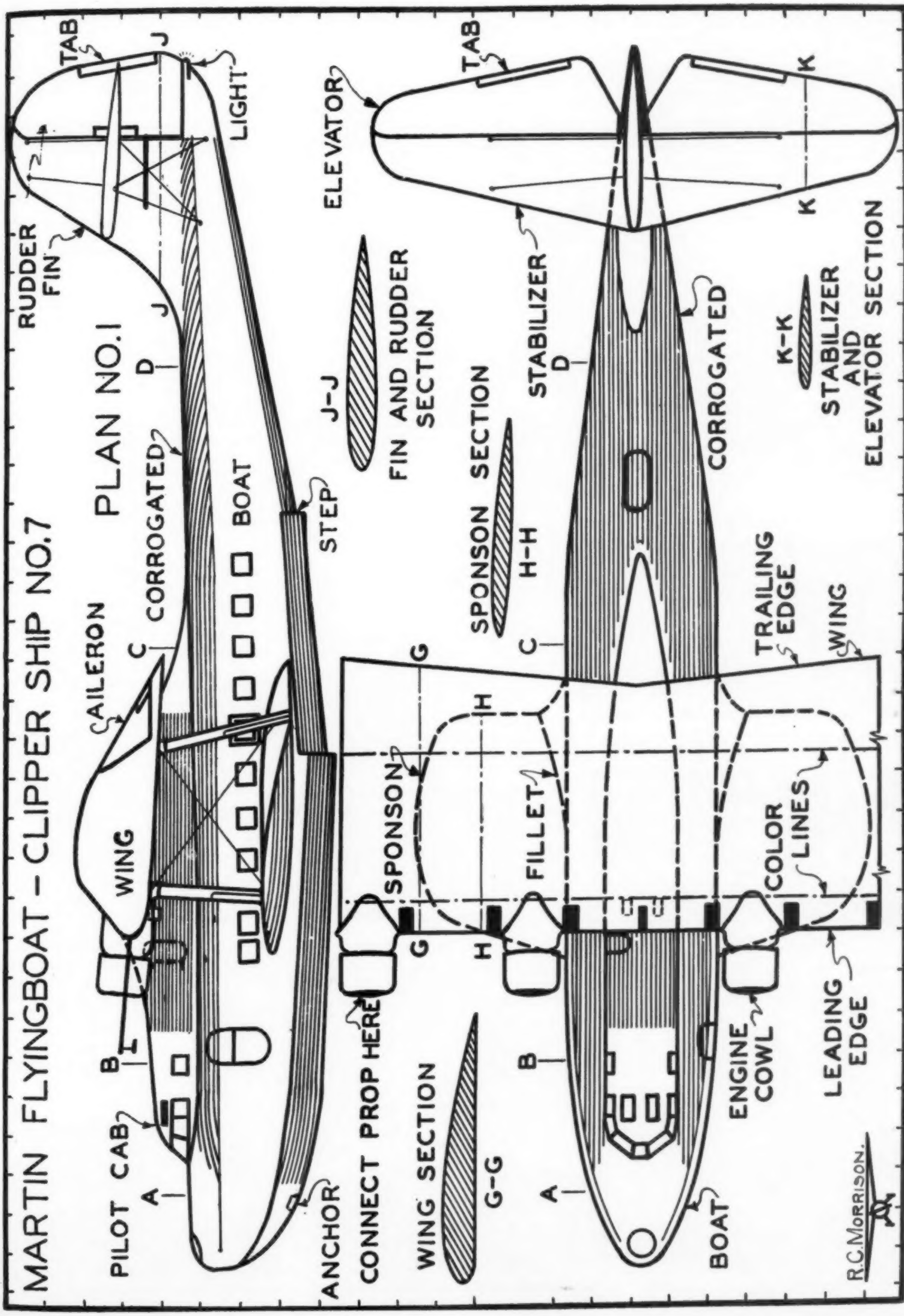


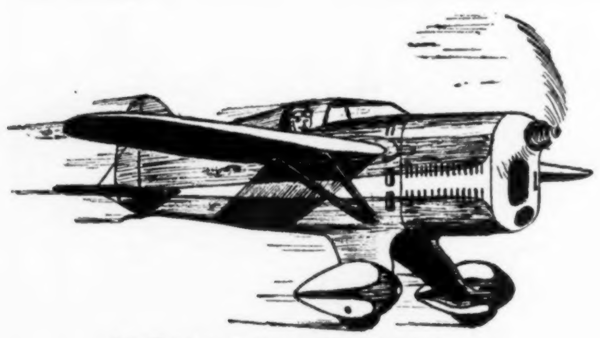
The 230 m.p.h. Douglas XO-46 with a Twin Wasp, Jr., (700) hp.



The Boeing XF6B-1, with Wasp 700 hp. engine. Speed 250 m.p.h. (By McLarren)


MARTIN FLYINGBOAT
CLIPPER SHIP NO.7.
PLAN NO.2.
JOIN TO PLAN NO.1
BOAT CROSS-SECTIONS
A-A
B-B
C-C
D-D
BOAT CROSS-SECTIONS
AUTHENTIC DRAWINGS
COWL
LANDING LIGHT
AIRSPEED INDICATOR
LEADING EDGE
WING
COLOR LINES
TAB
AILERON
TRAILING EDGE
F
E
F-F
E-E
WING SECTIONS
RUDDER
HAMILTON CONTROLLABLE PITCH PROPELLER
ROBERT C. MORRISON.

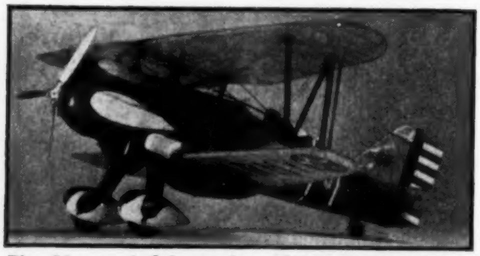

MARTIN FLYINGBOAT - CLIPPER SHIP NO.7
PLAN NO.1
PILOT CAB
WING
AILERON
CORROGATED
CORROGATED
BOAT
STEP
RUDDER FIN
TAB
LIGHT
ANCHOR
CONNECT PROP HERE
WING SECTION
G-G
J-J
FIN AND RUDDER SECTION
SPONSON SECTION
H-H
ELEVATOR
TAB
STABILIZER
CORROGATED
K-K
STABILIZER AND ELEVATOR SECTION
TRAILING EDGE
WING
SPONSON
FILLET
COLOR LINES
ENGINE COWL
LEADING EDGE
BOAT
R.C. MORRISON.



Art Chester's Racer, by Willard C. Tjossen

AIR WAYS HERE AND THERE

What Readers Are Doing to Increase Their Knowledge of Aviation in All Parts of the World. Send Pictures and Details of Your Experiments



Pict. No. 1. A flying scale model Curtiss Hawk P6-E of fine workmanship, by Glen E. Courtwright

Pict. No. 9. An American F11C-2 Curtiss Hawk by an English builder, G. W. Broom, Jr.

Pict. No. 4. A flying scale Japanese Kawasaki Fighter by Francis Bachhuber; a neat job

THIS month we welcome another young artist, Willard C. Tjossen of 568 South 11th Street, San Francisco, Calif., as a contributor to our Air Ways column. He has pictured Art Chester's Racer in a very realistic manner. Probably model fans will recall that Art Chester has been making air history recently with his machines.

Glen E. Courtwright of 515 Hamilton Street, Lincoln, Ill., presents picture No. 1. It is of his ¾-inch scale Curtiss Hawk. He says, "It is a flying model but I have never tried to fly it." How anyone can resist flying a flying model is more than we can understand, unless the builder treasures his workmanship more highly than the momentary thrill that he will have from seeing the model soar gracefully over the landscape. All details have been carefully carried out, even the pilot has goggles. But Courtwright adds, "There is not much expression on his 'pan.'"

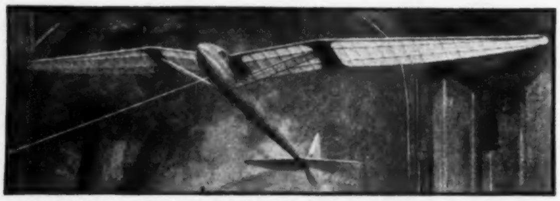
Gas model fans probably know Irwin G. Ohlsson of 1437 Bellevue Avenue, Los Angeles, Calif., one of the most active builders on the West Coast. He has a very beautifully built gas job, which was shown in Air Ways last month. Picture No. 2 shows the metal motor mount and the inverted Brown Jr. engine with which his ship is equipped. Ohlsson has made a very clever job of it. The mounting with the engine fits directly onto cleats on the front bulkhead of the fuselage.

Don Stevens and Ted Ballak are busy designing and building model sailplanes at Wilmington, Del. Picture No. 3 shows a model of the Bowlus Dupont Sailplane built from a kit. It has a spread of about 6 feet and is a beautiful job. This glider stayed up for 3 or 4 minutes, not soaring, but gradually gliding downward, without the help of air currents. From an altitude of about 250 feet it glided for about a mile. It is very easy to control the ship with the rudder. I am sure that either of these young men will be glad to answer questions concerning this plane.

Francis E. Bachhuber of Tripp Hall, Madison, Wis., contributes picture No. 4, showing his model Kawasaki Fighter, made from plans which appeared some time ago in this magazine. It is beautifully made and gives fine flights. Mr. Bachhuber remarks in his letter, "I happen to be a law student in the University of Wisconsin and the few hours a week spent in working with my fingers takes a little of the strain off the head and really leads to a more balanced existence. I think more of the older fellows ought to try it. I solemnly assure them that it has not made me a hermit and that the chances are that it won't do it to them. Of course, you can't help but learn a little some-

Pict. No. 5. A high speed model by Elbert Weathers

Pict. No. 2. The motor mounting of Irwin G. Ohlsson's gas model. It is made of dural angle strips riveted together



Pict. No. 3. Ted Bellak's and Don Stevens' 6 foot model Bowlus Dupont Sailplane

Pict. No. 8. A very stable 8 foot high-wing gas model, by Clyde Goehring

Pict. No. 6. Carl Thompson and his gas job

thing about the mechanics of airplanes, though that is not my chief object in building models; all the discussion of late as to floaters and models of good, solid walnut, etc., to the contrary."

One of our well-known experienced model designers is Elbert J. Weathers of 2720 Poinsettia Drive, San Diego, Calif. He has been experimenting with model racing planes recently. One of them is shown in picture No. 5. It certainly looks very "snappy." Some of the characteristics are as follows: wing span 26 inches, fuselage over-all 21½ inches, four-bladed propeller, 8½ inches diameter. Weathers says that this is the fastest racing plane that he has built so far. He has employed the use of wing fillets which he claims has increased its speed considerably. As an indication of its speed he recently attempted to photograph it, using 1/100 of a second exposure. Even with this small exposure, the plane was blurred in the picture so that it could not be recognized. Some ship!

A young aeronautic pioneer, Carl W. Thompson, Jr., of 64 New Street, Naugatuck, Conn., is pushing the frontiers of experimentation with gas model planes along in the state of Connecticut. He is shown in picture No. 6 with the gas job with which he has made some excellent flights. Recently on one flight, the gas tank was filled and the plane rose to an estimated height of 2,000 feet, flying in the direction of Waterbury from Naugatuck. It was followed in an airplane until it was lost to view. It was later found about 8 miles from the starting point. Thompson hopes to enter the plane at the Eastern States Outdoor Contest which will be held at Hadley Field, New Brunswick, N.J., on May 25th.

Our photographers are at it again! V. Fiegen of 2111 Schiller Avenue, Wilmette, Ill., has contributed picture No. 7 of a Howard "Ike." He is standing in front of the ship. When we tell you that this is a "faked" picture and the ship is only a model we expect you will doubt our veracity. However, it is the truth. This merely shows how contributors can fool editors on many occasions. We would say that Fiegen is a master in photographic art as well as an excellent builder. The details of the model are excellent, so much so that it is difficult to detect any difference between it and the full-size ship.

Picture No. 8 shows an excellent 8 foot gas model constructed by Clyde D. Goehring of 409 South Highland Avenue, Baltimore, Md. The ship was test flown on Jan. 6 at the Curtiss-Wright Airport in Baltimore. It was assembled at the field by Mr. Goehring and members of the Red Comet Model Airplane Club, prior to the flight. On the very first flight the model took off and flew around the field, gliding down to a perfect landing. It remained in the air 43 seconds. After this, six successful flights were made. The last flight lasted for 10 minutes, 48 seconds. The ship flew in graceful circles at an altitude of about 500 feet. Aviators at the field were very much surprised.

This ship showed unusual stability. The high parasol wing unquestionably contributed to it, for ships of this design have been fine flyers. *(Continued on page 46)*

Pict. No. 7. Not a real plane. Just a model "doctored up" by means of trick photography, by V. Fiegen

Pict. No. 11. Busy model flyers at a contest in France

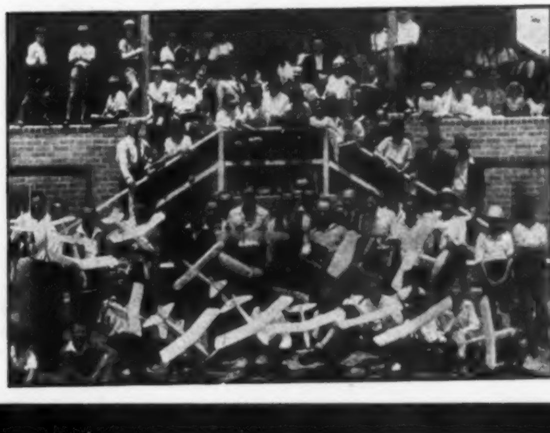
Pict. No. 10. A German radio-controlled gas-powered model

Pict. No. 15. Mary Walker, secretary of Bamberger Aero Club, and C. H. Grant discuss gas engines

Pict. No. 13. An old model builder instructs his son

Pict. No. 14. Haaren High Model Club gets together for a contest

Pict. No. 12. (Right) A good example of the popularity of model flying in Australia



The K-G2 powered with a Brown Jr. Span, 10 feet, weight $6\frac{1}{2}$ pounds, time 23 minutes with $1\frac{1}{8}$ ounces of gas

How to Build a Reliable Gas Engine Model

Complete Data from Which You Can Build an 8-Foot Plane That Has Proved Itself to Be the Most Consistent Flyer in Its Class

By JOSEPH KOVEL

Part No. 1

HUNDREDS of model builders have cherished a dream of building and flying in their own airplane. Usually these aspirations have been thwarted by a lack of money and space, to say nothing of of the difficulties thrown in the path of genius by Department of Commerce regulations. Though these obstacles have undoubtedly saved lives, they have at the same time prevented possible advancement of aviation by diversified individual experiment.

The advent of the miniature gas-engine-powered plane helps the aviation fan to realize his dream to a large extent. Though these small ships will not take up a pilot, anyone who builds and flies one, receives in the process a complete course in aviation.

Gas engine buggies are not merely models, they are actually miniature airplanes, embodying the same problems of design and construction as full scale ships, even to motors that act balky. If you wish to advance your knowledge of aviation you cannot follow a better course than to build and fly the thoroughly tested ship which we are going to tell you how to build here. It is the result of two years of systematic experiment with two successful gas planes, the K-G1 and the K-G2.

The former placed second in the Eastern States Contest 1934, and second in the 1934 "Nationals" with a flight of 14 min., 2 sec., and has never crashed since the first experimental flights, though it has been flown many times. This ship weighed 7 pounds, had a wingspread of 8 feet, and was powered with a Brown Jr. engine.

The K-G2 was a refinement of the K-G1, weighing $6\frac{1}{2}$ pounds. The wingspread was increased to 10 feet and the tail surfaces enlarged in proportion. On test flights it has shown a consistent gliding angle of more than 13 to 1 and has remained aloft for over 23 minutes on $1\frac{1}{8}$ ounces of fuel. Its soaring qualities were remarkable on all occasions.

The K-G1 reaching for the sky on its first successful flight; time, 14 minutes

In order to give to our readers the "perfect" gas job, the finest qualities aerodynamically and structurally have been taken from each one of these two experimental planes and combined to give you the K-G3, a real thoroughbred. Complete instructions and plans to build this perfected gas engine model follow.

Though the plans given here are for an 8-foot ship, those of you who wish to build a 6-foot model of it may do so by scaling the plans to three quarters of the present scale. To build the K-G2, a 10-foot ship, just add four 3-inch sections to each wing half, and increase the rudder area about 10 percent. The stabilizer may remain the same in this particular case. Read the following instructions and study the plans carefully before starting actual work on the model. (You may scale the wing and tail rib curves to size by following instructions. The rib sections are drawn to one-half scale. If you wish further information concerning how to make full scale ribs, write to "The Editor, Model Airplane News."

Remember that, as in the case of real ships, strength is given first consideration in this ship. Be sure to make good cement joints and use a good grade of wood. Avoid creased, split, knotty and warped woods.

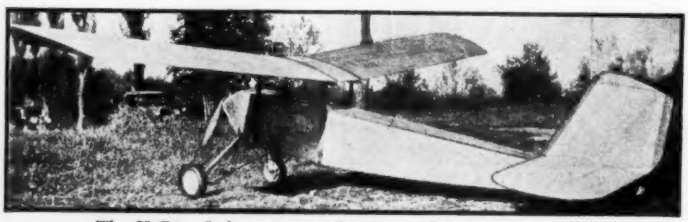
Where basswood is specified, try to use bass. However, if you have any trouble getting bass, you may use spruce which is just about as good. Poplar is the next choice. Do not use pine, as it is very brittle.

Take plenty of time building the ship, and if you are puzzled about anything, write to the author, *enclosing a stamped, self-addressed envelope.*

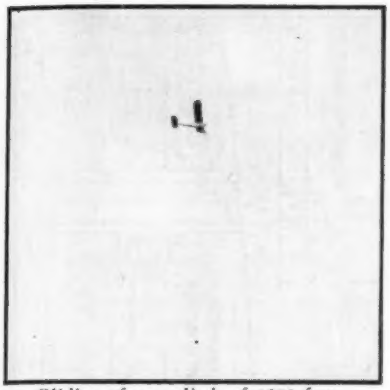
Now go to it! !

Stabilizer—(Plate 1)

It is rather unusual to start a model by building the tail unit first, but in this case it is done for a very good reason. Most of the boys who read this



The K-G1. It has a span of 8 feet and weighs 7 pounds



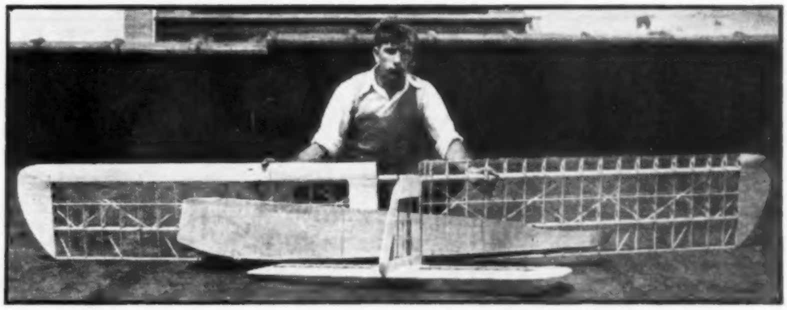
Gliding after a climb of 1200 feet

article and intend building a gas model, have not had any experience building any real large ships and are therefore at a loss as to what big-ship construction is really like. By building the tail unit first, they will get the "feel" of the job and gain confidence as they go along.

A—Ribs

The first job in building the stabilizer is to make the ribs. The stabilizer ribs D' and E' are given on plate 2. The rib curves on this plate are drawn to half scale. In order to get the full size of the curves, rule a 14"x20" sheet of paper with ½" squares, make dots at the points of intersection that each rib makes with the squares, then join the dots with a line, using the same type of curve shown on plan.

If you have access to a band saw or a jig saw, it is only necessary to make a cardboard template for the stabilizer ribs. This is made by cutting out the piece of paper containing the stabilizer curve from the enlarged plate 2 you have drawn, pasting it on a piece of cardboard, then cutting the cardboard to the correct shape, 1P. Take about 14 sheets of 1/16"x1½"x12½" medium hard balsa, pin them together, draw the rib curve on the top sheet, using the cardboard template as a pattern, then proceed to cut the rib blanks out on the band saw, 1P. However, if you haven't access to either a band saw or a jig saw and must make the ribs by hand in order to insure accuracy, it is advised that you make a metal template (either aluminum or brass sheet—about 1/20" thick). Make the template, using the method described for making the cardboard template. Then, with a hack saw to make the rough cut and a fine nail file for the finishing work, cut out notches for the leading and trailing edges.



The author with the completed wood parts of the K-G2. Note frame detail

It gains altitude steadily

The K-G2 climbing after the take-off

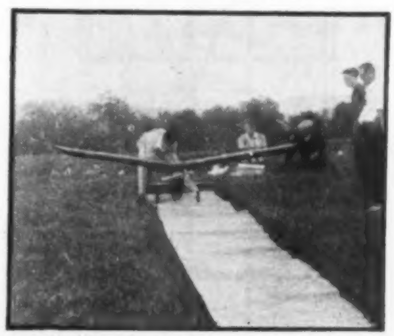
Cut out ⅛"x¼" notches at the top and bottom of the front, center and rear spar stations. Mark out the centers of the 4 lightening holes, then drill a 1/16" diameter hole through these centers. Drill a ¼" dia. hole in the center of the leading section of the rib template, and another ¼" dia. hole in the center of the trailing section of the rib. Fit a 3/16" dia.x1" app. length bolt through each of the ¼" holes and put wing nuts on the bolts.

The rib template is now finished and you are ready to start actual work on the ribs.

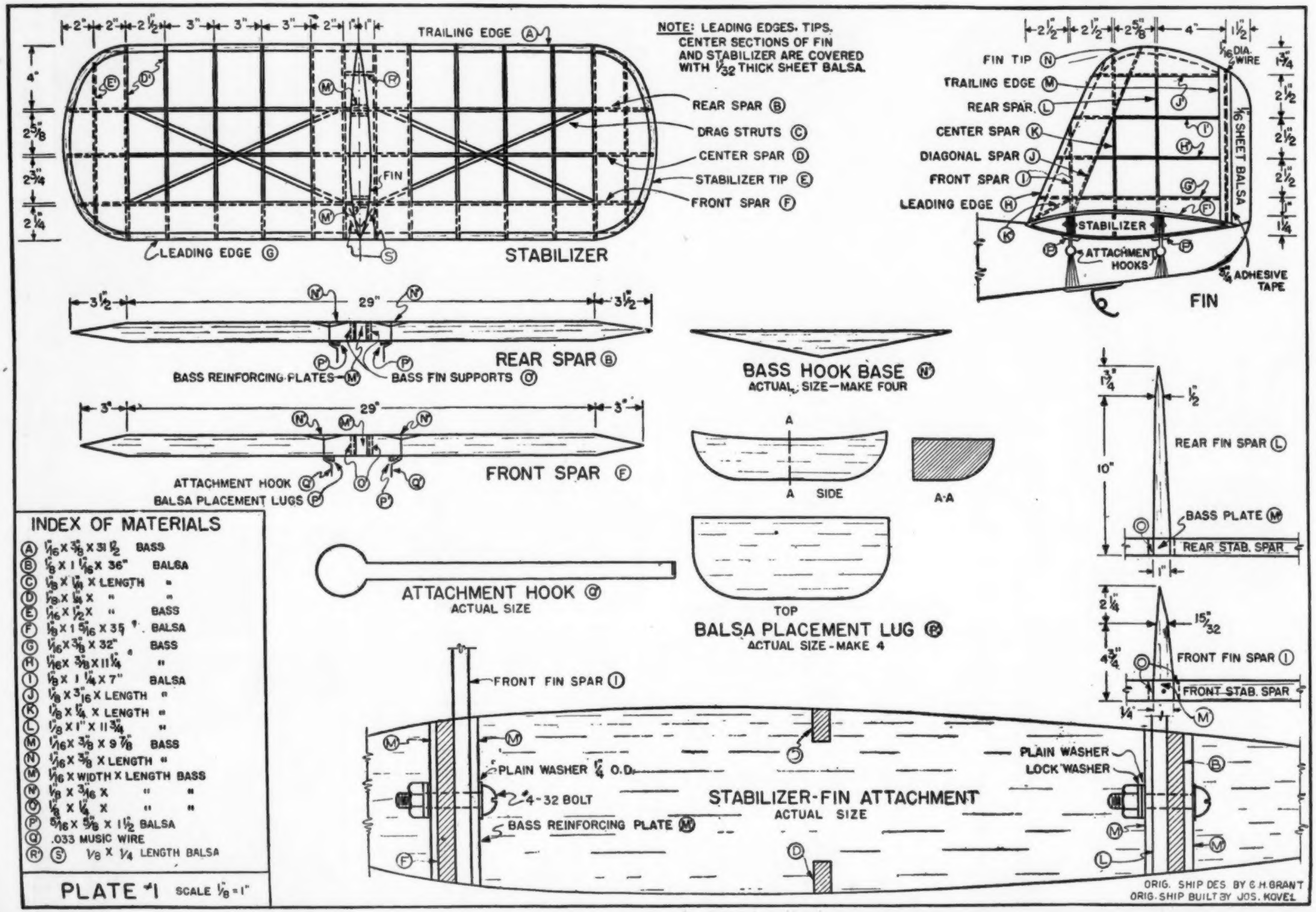
The completed framework of the tail surfaces with their builder

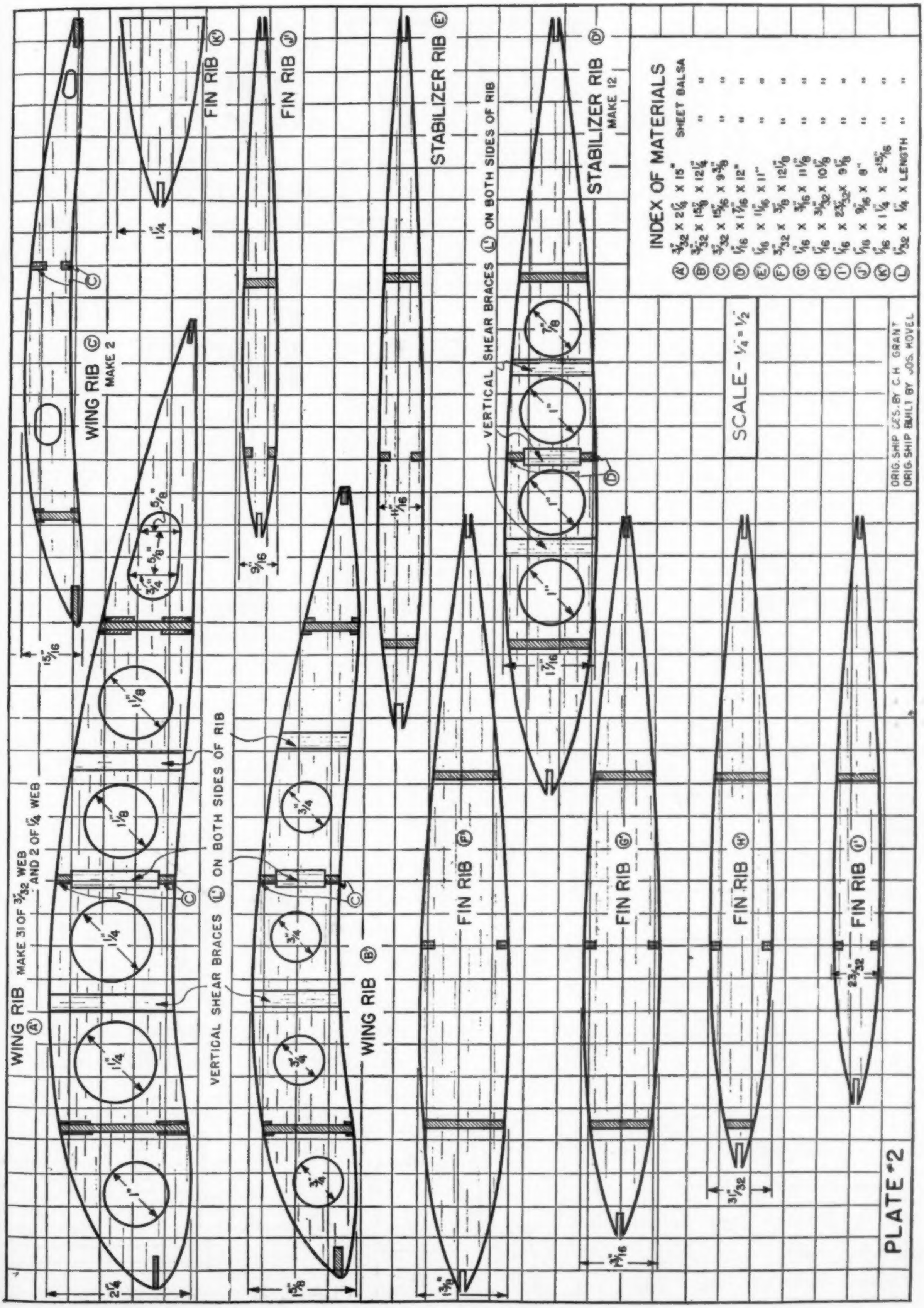
(See rib-carving detail on plate 3 for illustration, 1P.) The procedure for carving the ribs is as follows: 1. Place the sheet of rib wood balsa, medium hard grade (about 1/16"x1½"x12½") on your work board or table. 2. Lay the metal rib template over the sheet of wood, then push the bolts through the holes you have drilled in the template. This will adequately score the balsa sheet underneath so that you may now pick up the template and wood sheet, and push the bolts all the way through the wood. Put the wing nuts on the bolts, tighten them slightly and the wood sheet is now firmly held to the template and ready for carving. 3. With a sharp knife or razor blade, cut the balsa sheet to the same shape as the template. (Be sure to cut with the grain, not against the grain.) Sand lightly with a sanding block. 4. Push a pencil point through the 1/16" dia. holes in the template, so as to make out the centers of the circles on the balsa rib. With a nail file, cut out the notches for the leading edge, trailing edge, front, rear and center spars, and the rib blank is finished. Carve about 14 rib blanks, following the same procedure. 5. With a compass, using the dots you make on the ribs as centers, draw the circles shown on the stabilizer rib plan. Cutting out the lightening holes with a knife or razor blade is a tedious job, as the writer found out, so it is suggested that you use a die to cut these holes in the ribs. Many of you have used the end of a pencil, minus eraser, to cut lightening holes in the ribs of rubber-powered ships, so you are probably familiar with the method. Take a thin-walled cylinder of the proper diameter, sharpen one end of it with a file (the inside wall) and you are ready to work with it. Practice with it first on a scrap sheet of balsa until you get the technique of it,

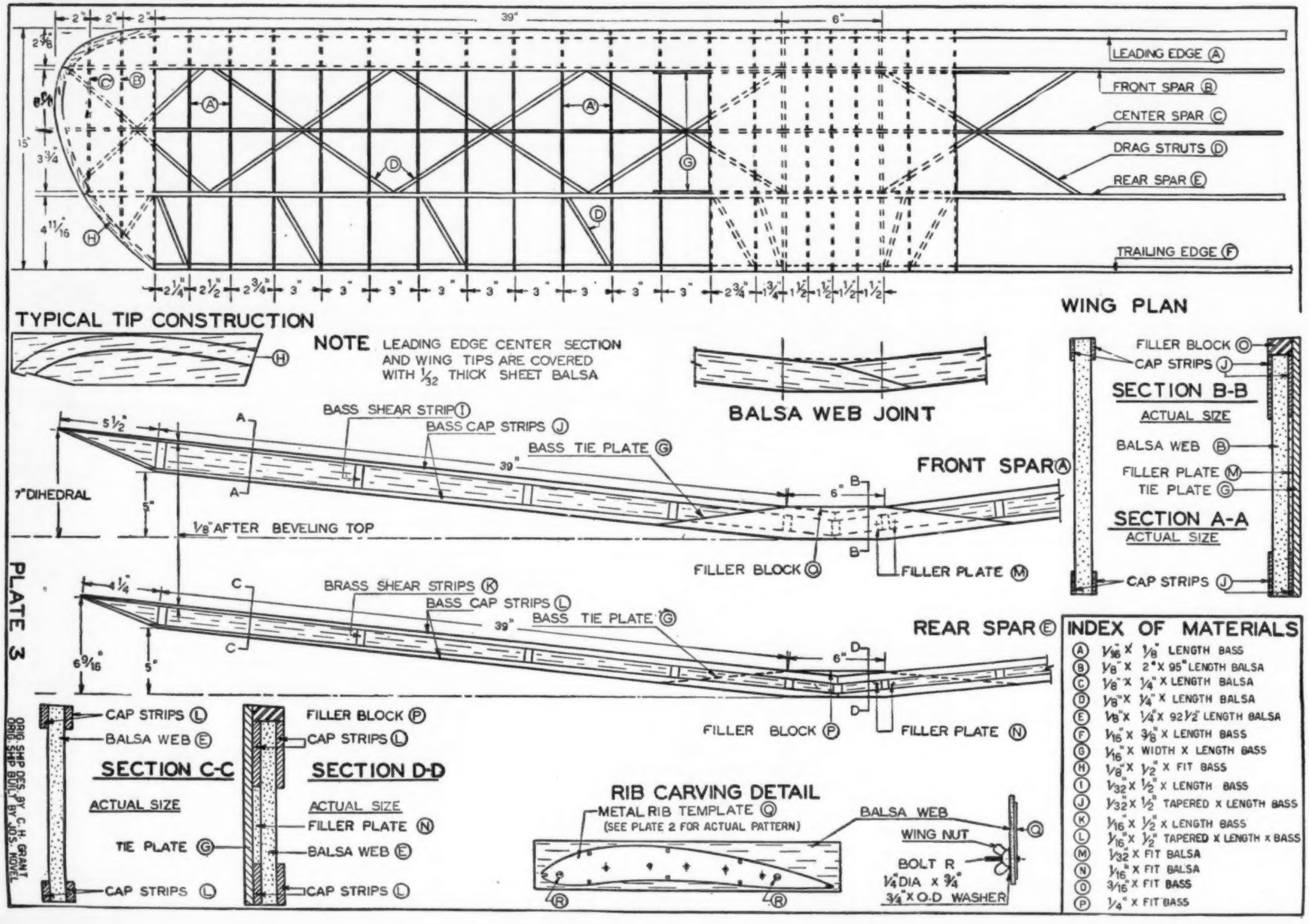
(Continued on page 40)



A roll of roofing paper made a good runway for the take-off


NOTE: LEADING EDGES, TIPS, CENTER SECTIONS OF FIN AND STABILIZER ARE COVERED WITH 1/32 THICK SHEET BALSA.
STABILIZER
TRAILING EDGE (A)
REAR SPAR (B)
DRAG STRUTS (C)
CENTER SPAR (D)
STABILIZER TIP (E)
FRONT SPAR (F)
LEADING EDGE (G)
FIN
FIN TIP (N)
TRAILING EDGE (M)
REAR SPAR (L)
CENTER SPAR (K)
DIAGONAL SPAR (J)
FRONT SPAR (I)
LEADING EDGE (H)
1/16 DIA. WIRE
1/16 SHEET BALSA
STABILIZER
ATTACHMENT HOOKS
3/4 ADHESIVE TAPE
REAR SPAR (B)
BASS REINFORCING PLATES (M)
BASS FIN SUPPORTS (O)
FRONT SPAR (F)
ATTACHMENT HOOK (Q)
BALSA PLACEMENT LUGS (P)
BASS HOOK BASE (N)
ACTUAL SIZE—MAKE FOUR
SIDE
A-A
TOP
BALSA PLACEMENT LUG (R)
ACTUAL SIZE - MAKE 4
REAR FIN SPAR (L)
BASS PLATE (M)
REAR STAB. SPAR
FRONT FIN SPAR (I)
FRONT STAB. SPAR
ATTACHMENT HOOK (Q)
ACTUAL SIZE
STABILIZER-FIN ATTACHMENT
ACTUAL SIZE
FRONT FIN SPAR (I)
PLAIN WASHER 1/4 O.D.
4-32 BOLT
BASS REINFORCING PLATE (M)
PLAIN WASHER
LOCK WASHER
INDEX OF MATERIALS
(A) 1/16 X 3/8 X 31 1/2 BASS
(B) 1/8 X 1 1/16 X 36" BALSA
(C) 1/8 X 1/8 X LENGTH "
(D) 1/8 X 1/4 X " "
(E) 1/16 X 1/2 X " BASS
(F) 1/8 X 1 5/16 X 35 BALSA
(G) 1/16 X 3/8 X 32" BASS
(H) 1/16 X 3/8 X 11 1/4 "
(I) 1/8 X 1 1/4 X 7" BALSA
(J) 1/8 X 3/16 X LENGTH "
(K) 1/8 X 1/4 X LENGTH "
(L) 1/8 X 1" X 11 3/4 "
(M) 1/16 X 3/8 X 9 7/8 BASS
(N) 1/16 X 3/8 X LENGTH "
(M') 1/16 X WIDTH X LENGTH BASS
(N') 1/8 X 3/16 X " "
(O) 1/8 X 1/4 X " "
(P) 5/16 X 5/8 X 1 1/2 BALSA
(Q) .033 MUSIC WIRE
(R) (S) 1/8 X 1/4 LENGTH BALSA
PLATE #1 SCALE 1/8=1"
ORIG. SHIP DES BY G.H. GRANT
ORIG. SHIP BUILT BY JOS. KOVEL


WING RIB (A) MAKE 31 OF 3/32 WEB AND 2 OF 1/4 WEB
VERTICAL SHEAR BRACES (L) ON BOTH SIDES OF RIB
WING RIB (B)
WING RIB (C) MAKE 2
FIN RIB (K)
FIN RIB (J)
FIN RIB (F)
FIN RIB (G)
FIN RIB (H)
FIN RIB (I)
STABILIZER RIB (E)
STABILIZER RIB (D) MAKE 12
VERTICAL SHEAR BRACES (L) ON BOTH SIDES OF RIB
INDEX OF MATERIALS
(A) 3/32 x 2 1/4 x 15" SHEET BALSA
(B) 3/32 x 1 5/8 x 12 1/4 " "
(C) 3/32 x 15/16 x 9 3/8 " "
(D) 1/16 x 1 7/16 x 12" " "
(E) 1/16 x 11/16 x 11" " "
(F) 3/32 x 3/8 x 12 1/8 " "
(G) 1/16 x 3/16 x 11 1/8 " "
(H) 1/16 x 31/32 x 10 1/8 " "
(I) 1/16 x 23/32 x 9 1/8 " "
(J) 1/16 x 9/16 x 8" " "
(K) 1/16 x 1 1/4 x 2 15/16 " "
(L) 1/32 x 1/4 x LENGTH " "
SCALE - 1/4" = 1/2"
ORIG. SHIP DES. BY C. H. GRANT
ORIG. SHIP BUILT BY JOS. KOVEL
PLATE #2


WING PLAN
LEADING EDGE (A)
FRONT SPAR (B)
CENTER SPAR (C)
DRAG STRUTS (D)
REAR SPAR (E)
TRAILING EDGE (F)
39"
6"
15"
TYPICAL TIP CONSTRUCTION
NOTE LEADING EDGE CENTER SECTION AND WING TIPS ARE COVERED WITH 1/32 THICK SHEET BALSA
BALSA WEB JOINT
FRONT SPAR (A)
BASS SHEAR STRIP (I)
BASS CAP STRIPS (J)
BASS TIE PLATE (G)
7" DIHEDRAL
1/8" AFTER BEVELING TOP
FILLER BLOCK (O)
FILLER PLATE (M)
REAR SPAR (E)
BRASS SHEAR STRIPS (K)
BASS CAP STRIPS (L)
BASS TIE PLATE (G)
FILLER BLOCK (P)
FILLER PLATE (N)
SECTION B-B
ACTUAL SIZE
CAP STRIPS (J)
BALSA WEB (B)
FILLER PLATE (M)
TIE PLATE (G)
SECTION A-A
ACTUAL SIZE
SECTION C-C
ACTUAL SIZE
CAP STRIPS (L)
BALSA WEB (E)
TIE PLATE (G)
SECTION D-D
ACTUAL SIZE
FILLER BLOCK (P)
FILLER PLATE (N)
RIB CARVING DETAIL
METAL RIB TEMPLATE (Q)
(SEE PLATE 2 FOR ACTUAL PATTERN)
BALSA WEB
WING NUT
BOLT R
1/4" DIA x 3/4"
3/4" X O.D WASHER
INDEX OF MATERIALS
(A) 1/16" X 1/8" LENGTH BASS
(B) 1/8" X 2" X 95" LENGTH BALSA
(C) 1/8" X 1/4" X LENGTH BALSA
(D) 1/8" X 1/4" X LENGTH BALSA
(E) 1/8" X 1/4" X 92 1/2" LENGTH BALSA
(F) 1/16" X 3/8" X LENGTH BASS
(G) 1/16" X WIDTH X LENGTH BASS
(H) 1/8" X 1/2" X FIT BASS
(I) 1/32" X 1/2" X LENGTH BASS
(J) 1/32" X 1/2" TAPERED X LENGTH BASS
(K) 1/16" X 1/2" X LENGTH BASS
(L) 1/16" X 1/2" TAPERED X LENGTH X BASS
(M) 1/32" X FIT BALSA
(N) 1/16" X FIT BALSA
(O) 3/16" X FIT BASS
(P) 1/4" X FIT BASS
PLATE 3
ORIG. SHIP DES. BY C. H. GRANT
ORIG. SHIP BUILT BY JOS. KOVEL

The Aerodynamic Design of The Model Plane

Article No. 38 — Chapter No. 4

A Comparison of the Energy Output of Lubricated, Stretched and Dry Wound Rubber Motors—Formulas Which Give Values for Torque, Turns and Work

By CHARLES HAMPSON GRANT

HOW heavy is black rubber? How heavy is brown rubber? Which gives the most torque, the most turns, the most power? If you should ask your model building friends these questions, you would probably receive as many different answers as you have friends. Some will say that brown rubber weighs less than black rubber, that black rubber gives more power than brown, that brown rubber sustains its power better than black, and other statements that seem to add only to the confusion of your thoughts on the subject.

As a matter of fact, each one of these statements may be absolutely correct. Each individual will give you the characteristics of the particular quality or brand of rubber that he tested. However, there is a great variation in the physical characteristics of different makes of rubber. This is so even when rubber of the same size is compared. It is essential to recognize this fact before it is possible to make practical use of the data obtained from rubber tests.

In order that the data given here may be properly estimated and applied, as well as correctly compared with data obtained from other experiments, the following facts are given concerning the rubber stock used in these tests.

The brown rubber used was qualified by the concern from which it was purchased as "high grade brown rubber." This make of rubber is used by model builders to a larger extent than any other brand. Careful measurements indicated that it was 1/8" wide and 1/30" thick exactly. It was fresh stock, but of sufficient age to have fully ripened. A single strand fifty feet long weighed exactly 640 grains. This stock was weighed several times on different scales in order to eliminate the possibility of error. Also, the single strand was carefully measured without stretching.

The black rubber stock used was the product of the U.S. Rubber Company, made to a reliable model company's special formula. Careful measurement showed the strands to be exactly 1/8" wide and 1/30" thick. (Not 1/32" thick.) Its age was the same as the brown rubber stock used, if the word of the makers is to be considered as accurate. I frankly say that the black rubber stock is some of the finest grade rubber I have seen. A single strand of this rubber 50 feet long, weighed exactly 620 grains, when weighed on the same scales as the brown rubber. Both grades of rubber were weighed within 5 or 10 minutes of each other.

Comparing the weights of these two grades of rubber we see that the brown rubber weighed 2 percent more than the black rubber. Tests of black and brown rubber made by other model plane experimenters have given different results. However, this can be explained only by the conclusion that rubber of different grades and weights were used, compared to the stock used in these tests. In fact, it is doubtful that any two grades of rubber will weigh the same or will deliver the same amount of power under given test conditions.

However, though there is a variation in the physical characteristics of rubber, the comparative results of motors of the same stock will be fairly accurate. Also, though there will be a variation in the results obtained from different rubber stock, this variation will not be so great as to prevent a comparison of different grades of the same size, within certain limits. Good judgment must be used. This, combined with the charts given here and a few tests of stock that may come to your hand, should help you to form a clear picture of the possibilities and correct application of various grades of stock.

Dry Rubber vs. Stretched and Lubricated Rubber

In order to understand fully the advantage gained by lubricating and stretching rubber when winding it, compared to the use of dry, unlubricated and unstretched rubber, let us compare charts No. 12, No. 13 and No. 14, in the December issue of UNIVERSAL MODEL AIRPLANE NEWS, with charts No. 23, No. 25 and No. 26 in the March issue. Comparing chart No. 12 for 1/8x1/30 dry rubber with chart No. 23 for stretched lubricated rubber of the same grade and size, we find that there is a 33 percent increase in the torque for a 2-strand motor when it is lubricated and stretched before winding it. For 4-, 6-, 8-, and 10-strand motors there is 100 percent or more increase in the maximum torque, under these conditions.

Comparing graph No. 13 with No. 25, for 1/16x1/30 dry rubber and lubricated stretched rubber respectively, we find that the same conditions exist. For 2-strand motors there is a 30 percent increase in maximum torque when the motor is stretched and lubricated before winding it. For 4-strand motors there is a 60 percent increase, for 6 strands there is a 100 percent or more increase, for 8 strands there is a 140 percent or more and for 12 strands an increase of 150 percent. The increase for 6- and 8-strand motors is a little more than stated here, according to the charts. However, from recent tests it is evident that the maximum torque for these motors, as given, is actually a little low. They should be 2.0 inch ounces for a 6-strand motor and 2.9 inch ounces for 8 strands.

In 1/32"x1/30" rubber, there is no increase in the case of 2-strand motors. In fact there is about a 15 percent decrease when a lubricant is used and the motor stretched before winding. This would indicate that it is better to use unstretched dry rubber motors when the motor is to be composed of few strands of fine rubber. However, in the case of 4-strand motors, lubricating and stretching gives an increase of 22 percent, 6 strands give 50 percent increase, 8 strands give 90 percent and 12 strands give an increase of 112 percent.

A comparison of the number of turns that can be stored in the two types of motors, dry and lubricated stretched motors, shows a very large increase for the latter. For 1/8x1/30 rubber the increase in the possible number of turns is from 132 percent for a 2-strand motor to 90 percent for a motor of 10 strands.

The percentage increase in the case of motors of 1/16x1/30 rubber is not quite as great. It ranges from 78 percent to 114 percent. For 1/32x1/30, the percentage increase is still less, ranging from 55 percent to 115 percent. It appears that the smaller the strands are that compose the motor, the less the benefit derived from lubricating and stretching the rubber. However, the increase is considerable in all cases, and for duration flights, motors should always be lubricated and stretched.

As there has been an increase both in the maximum torque and in the number of turns it is possible to store in a motor when it is lubricated and stretched, it is only logical to presume that there is an increase in the amount of work that can be stored in such a motor. An examination of the charts and a careful check of the squares under the curves will show a decided increase in the amount of work that can be stored in lubricated, stretched motors.

A comparison of charts No. 12 and No. 23 shows an increase of 100 percent or more in the case of every motor, whether of 2 strands or 10. To be exact, it is 106 percent in the case of a 2-strand motor of 1/8x1/30 rubber, and 116 percent for a 10-strand motor.

The same general condition exists in the case of motors of 1/16x1/30 and 1/32x-1/30 rubber. The increase in the amount of work ranges from 95 percent to 140 percent.

Possibly some readers with an eye for grace or with a mathematical bent, have noticed that the torque curves of the graphs and a line drawn to pass through the points of maximum torque, form smooth unbroken curves. This fact is significant of a regular mathematical relationship existing between the torque (measured vertically), the turns measured horizontally, and the number of strands in the motors. Briefly the torque is a function of

(Continued on page 39)

NATIONAL AERONAUTIC ASSOCIATION JUNIOR MEMBERSHIP NEWS

Prepared by National Aeronautic Association, Washington, D. C.

National Championship Meet

THE 1935 National Championship Model Airplane Meet, scheduled for June 27-29 in St. Louis, Mo., promises many thrills and unexpected features that make it certain to be one of the most successful meets ever held.

This annual event, the climax of the year's model airplane contest program, is looked forward to by the country's outstanding experts as the one meet that must not be missed. It is here that the stiffest competition is met, the very best of new ideas are demonstrated, new national records are established. Here, old friendships are renewed, new contacts made, contests of former years recounted.

It would be successful as a great meet, even though there were no tangible rewards such as prizes. Simply to win first place in one or more of the traditional contests that make up the meet would satisfy most of the contestants. Such is the spirit of our model airplane enthusiasts.

However, this year's sponsors, the Junior N.A.A. Chapter of St. Louis, Stix Baer & Fuller Company, and the National Aeronautic Association, are cooperating to provide many exceptional awards besides the usual standard trophies and cups that have always been awarded to the winners. The complete list of prizes is not yet made up, but advance indications are that it will be a thoroughly imposing one.

Of course there will be the customary events: Mulvihill, Stout Indoor, Stout Outdoor, Bloomingdale, Texaco, Model Airplane News, Balfour, Moffett, and Springfield Contests. The National Aeronautic Association will award the above-named trophies to the winners of those events, to be retained for one year, and a miniature trophy to be held perpetually. Other prizes are being gathered so that exceptional flights will be adequately rewarded. The whole list will not be made known until the time of the meet.

Every air-minded organization in St. Louis will join the Stix Baer & Fuller Company in aiding that city's Junior N.A.A. Chapter to give each contestant a royal welcome. There will be sightseeing trips, extensive entertainment, the big banquet, and the very best of flying conditions for model planes.

Only Junior N.A.A. members are eligible to compete in this National Championship Meet, so do not delay in applying for membership or renewing your 1934 membership. The convenient coupon on these pages is there for that very purpose.

Full details and rules will be made available in following issues of this publication. Please do not write to the sponsors for additional information until the notice is published giving the address to which your applications are to be sent. This information will be made available in sufficient time for everyone. The contest rules and program of events will be quite similar to those of 1934.

Numerous cities have already made plans to send their local champions to St. Louis next June. If your home town or chapter has not made such arrangements, you might suggest it to the right parties and do some promotional work in other ways to insure your own attendance. If a provided trip cannot be arranged, you should start making plans for going to St. Louis by some other means.

THE National Aeronautic Association offers you model builders and flyers membership in a national aviation organization that insures recognition of record-making flights, quarterly bulletins that will keep you up to date in the latest refinements of the art, together with the realization that you are working right along with the leaders in national aviation. The Association aims to keep "America First in the Air." Those under 21 are entitled to membership as junior members at 25 cents a year with an additional initiation fee of 25 cents. Those over 21 may become regular members at $5 a year. A special model flying permit is offered to nonmembers who are over 21 at $1 a year.

Only N.A.A. members or those with special permits are eligible to compete for N.A.A. trophies and awards, or to have their flights given official recognition for record purposes. As the representative in the United States of the Federation Aeronautique Internationale, the Association has as a special responsibility the encouragement and regulation of air meets, races, and record trials.

Vernon B. Gray, Aukland, New Zealand, with his 28-minute model. Gray intends to enter the 1935 Moffett International Contest

News From the Chapters

BELOIT, Wis., Junior N.A.A. Chapter, known as Hangar No. 13, held its semi-annual election at the end of 1934 and the following officers were elected: Elwin Lindsley, Club Commander; Eddie Howard, Assistant Commander; J. B. Hankins, Secretary-Treasurer. William Bates and Alfred Heim declined nominations after serving two terms as Commander and Secretary-Treasurer, respectively. The former Assistant Club Advisor, Frank Ross, Jr., was returned to that position upon his return to Beloit after being out of the city for some time.

Mr. Conrad W. Hansen, Jr., Club Advisor, reports that about twelve members expect to make the trip to St. Louis for the National Championship Meet, each one a contestant. Last year four members drove to Akron just to see the flying without entering as contestants.

The club intends to hold two outdoor N.A.A. sanctioned meets this year. The Beloit Lions Club has declared its willingness to help sponsor a contest and put up a suitable trophy. This contest is expected to take in the territory north of Chicago and south of St. Paul.

Club members are working on a gas model and hope to spring some surprises with it. Sounds interesting and shows the correct spirit.

INDIANAPOLIS Junior N.A.A. Chapter members have commenced building their models already for St. Louis. Indications are that there will be a larger delegation from Indianapolis this year than in 1934. Two national champions, Vernon Boehle and Jim Cahill, are Indianapolis members. Boehle plans to enter each flying event, indoors as well as outdoors. That means plenty of competition for all entrants.

There are plans under way for an official N.A.A. contest in Indianapolis this spring. The club is an active one and has many successful builders. A large representation at National Meets has always been present from Indianapolis under the untiring leadership of Mr. Arthur Boehle, Vernon's father.

PHILADELPHIA has its winter season of contests well along and several new records have been reported by Mr. Victor Fritz, Field Director of the Philadelphia Model Aeroplane Association. One indoor contest for juniors and one for seniors and open class members is held each month.

This club has its quota of national champions in their respective events. Possibly most famous of all is Maxwell Bassett, the gasoline-powered model expert. Bassett hopes to compete in St. Louis and is working on two new models of advanced design for that very purpose.

Among some of the recent winners in Philadelphia contests, the following well-known names appear: Hyman Oslick, William Latour, Robert Jacobson, James Miller, William Reiss, Richard Siegel, Ervin Leshner, Robert Wilde, William Sharp, Richard Grannis, John Becht, and Charles Heintz.

NEWARK, N.J., Junior N.A.A. Chapter, the Bamberger Aero Club, held its annual winter indoor meet in Sussex Armory on Feb. 16. The results of this meet were not available as this was written. The meet was, as all of this club's meets, held under official N.A.A. sanction.

Mr. Nathan Polk, Club Director, reports that his organization will cooperate with MODEL AIRPLANE NEWS in sponsoring the 1935 Eastern States Outdoor Meet at Hadley Field on May 25.

The B.A.C. held an aviation scrapbook exhibition last month in the clubroom. John Coe won first place while Frank Ehling was the second place winner. Their scrapbooks were complete records of aviation from the Wright brothers' flights to the present day powerful transport planes. Coe's entry also had a full record of lighter-than-air craft and aviation power plants.

Mr. Polk has been most active in arranging entertaining and educational meetings weekly in the B.A.C. clubroom provided by L. Bamberger & Company. One of the features is a "Skeeter" contest for flying models of less than 6-inch wing span.

Club members are looking toward St. Louis and several intend to make the trip. Herbert Greenberg, the club's outstanding champion, expects to be on hand to defend his 1934 Stout Indoor championship, and to win further recognition in other events.

BOSTON'S Junior N.A.A. Chapter, the Jordan Marsh Junior Aviation League, continues to publish that most interesting and oldest model airplane weekly, *Wing Overs*, very competently edited by Al Lewis. It contains technical matter, news items, philosophic ramblings, and comics.

Captain Willis C. Brown, the club's director, holds frequent contests in one of the armories. He reports that there is a lot of interest in indoor semiscale flying models. Unfortunately, the Boston Armory is not adequate for making many record flights. In spite of this handicap, two new glider records were established by Kenneth Nelson and Louis Young.

Vernon Boeble, Indianapolis, expert model builder with his outdoor fuselage model at the 1934 National Championship Meet

The Boston fellows are hoping that another N.A.A. meet will be held in the Lakehurst dirigible hangar this spring and promise a good-sized turnout if such a meet is arranged. They are also casting speculative glances out toward St. Louis and figuring ways and means of making that trip.

One of the Boston club's star members, Arthur Kronfelt, is now employed by the Chance Vought Corporation in the production of full-sized planes. The valuable experience gained in model building is undoubtedly proving helpful.

At a recent club meeting, Mr. J. B. Kendrick of Massachusetts Institute of Technology, spoke to a full house and told just how the huge wind tunnels are used to determine the usefulness of various wing sections.

American Legion 1935 Meet

THE American Legion has announced its third annual national model airplane contest to be held at Indianapolis, August 24-25. The Legion's National Aeronautics Commission has made this an annual contest with two years' successful experience indicating the desirability of continuing it each year.

It is planned that each interested Legion Post should have as many entries as possible participate in District contests and the District winners then compete in Department contests. The Department winners are then to compete in the national contest.

Indoor and outdoor flying will be scheduled. All ages are eligible. The prizes are to include gas engines, watches, binoculars and other useful articles. For the most part, N.A.A. contest rules will be in effect.

All those who are interested, are urged to write to Maj. Weir Cook, Director Aeronautics Commission, The American Legion National Headquarters, 777 North Meridian Street, Indianapolis, Ind. Be sure to enclose a stamped, return addressed envelope with your letter.

New Model Flight Records

FOUR new records have been given official recognition. On Dec. 1, 1934, two Boston Junior N.A.A. members set glider records in the Junior Aviation League Indoor Meet. Kenneth Nelson flew his Class A glider 26.6 seconds for a new junior record. Louis Young made a Class B junior record of 19 seconds. Both of these were made at the Irvington Street Armory and are especially noteworthy as flying conditions were not of the best.

On Dec. 15, 1934, Hyman Oslick of Philadelphia, flew his Class B Fuselage R.O.G. model 7 minutes 59.6 seconds for a new junior record. William Latour, also of Philadelphia, on Jan. 19, 1935, flew his Class B Fuselage R.O.G. model 6 minutes 48 seconds for a new open-class record. These Philadelphia records were established in regular monthly P.M.A.A. meets.

All four of these records were made in officially sanctioned N.A.A. model flying meets, the only way in which N.A.A. recognized records may be established. As the quality of records improves, it becomes increasingly difficult to improve over former record flights. There is still ample room for better flight times as is proved by the constant upward trend of the listed records. The coming season is expected to produce some amazing standards.

Moffett International Contest

THE 1935 International Contest for the Rear Admiral William A. Moffett Memorial Trophy is to be a part of the National Championship Meet at St. Louis, Mo., June 27-29. The rules for this contest are as follows:

Models shall be of the OUTDOOR FUSELAGE MODEL type and rise off the ground. The effective main supporting surface shall be no less than 100 square inches nor more than 200 square inches in area. Models shall weigh, ready to fly, at least 1 ounce avoirdupois for each 50 square inches of wing area. In this contest only one model may be used by a contestant. Foreign entries, excepting Canadian, may fly by proxy. Each country is allowed a team total of six members. The American and Canadian teams will be selected by elimination flying on the day of the contest. Details of this elimination will be explained upon arrival in St. Louis. A model to be eligible in this contest shall

NATIONAL AERONAUTIC ASSOCIATION OF U.S.A.
DUPONT CIRCLE
WASHINGTON, D.C.

I hereby make application for membership in the National Aeronautic Association as a Junior Member. I am under twenty-one years of age.
I enclose fifty cents for initiation fee and first annual dues (Use check or money order.)

Name ....
(Please print or type)

Street ....

City .... State ....

Date of Birth...
(Month, Day, Year)

Approved ....
(Parent sign here, if applicant is under eighteen)

not have been flown in any other contest of the meet. This contest is not restricted as to age. Foreign entries must be received in St. Louis not later than June 20. Ship foreign entries to: Model Airplane Director, Stix Baer & Fuller Company, St. Louis, Mo. All foreign entries must be authorized by the model plane governing body of their respective countries. Notice of this notification must be forwarded to the National Aeronautic Association, Dupont Circle, Washington, D.C., so as to arrive there prior to June 20.

Lyndhurst High School Meet

THE annual outdoor model flying meet of the Lyndhurst, N.J., High School Model Airplane Club, is to be held at Teterboro Airport, Teterboro, N.J., on Apr. 27. All model flyers, regardless of age or address are invited to attend. There are to be two classes; gasoline-powered models, and rubber-powered models. Any type of rubber-powered model is eligible but different types must compete on equal terms against each other.

All models must conform to N.A.A. specifications and the meet will be conducted in accordance with contest rules of the N.A.A. All records made by Junior N.A.A. members will be certified to the Contest Committee of the Association.

Entry blanks may be obtained from Francis Tlush, 755 Sixth Street, Lyndhurst, N.J. Be careful to enclose stamped and return addressed envelope when asking for entry blanks.

Prizes are to be trophies, cups, medals, and possibly, airplane rides. This meet will be well worth attending. Teterboro Airport has long been used by Col. Lindbergh. It is well situated on No. 2, New Jersey State Highway, easily accessible from New York City and vicinity.

Model Plane Terminology

IN the rather distant days when models were first coming into prominence, it was customary to call built-up fuselage models "Commercials." This is still the case in some quarters and it leads to some confusion on the part of the casual reader of model airplane news items, causing the reader to think that the term means the model was purchased commercially. This is so far from the true meaning of the term that it has been considered much more meaningful to call such models "Cabin Fuselage Models" or just "Fuselage Models." Since the model enthusiast should desire the general public to appreciate more fully the real status of these models, let's all get the habit of calling them by an intelligent term.

Along the same line, it used to be customary to call stick models by the name "Endurance" or "Duration." Nowadays, the cabin fuselage models have come to be such good duration flyers, it hardly seems fair to take away from them the right to be called true duration models. The easy way to differentiate is to speak of models as "Stick Models" or "Cabin Fuselage Models."

There also used to be a term "Scientific" applied to stick models. It seems perfectly evident that any good model that flies well, is a completely scientific creation and should be considered in that light.

OFFICIAL MODEL AIRPLANE RECORDS

Approved by Contest Committee of the N.A.A.

Through February 10, 1935.

INDOORS

STICK MODEL AIRPLANES, Hand-launched

CLASS B

Junior: John Whitehouse	Springfield, Mass.,	13m 04s
Senior: Ralph Kummer	St. Louis, Missouri	17m 49.8s
Open: Michael Lichstein	Philadelphia, Pa.	14m 45.8s

CLASS C

Junior: John Stokes	Huntingdon Valley, Pa.	18m 53.4s
Senior: "Pete" Andrews	Philadelphia, Pa.	20m 22.8s
Open: Carl Goldberg	Madison, Wis.	22m 59.4s

STICK MODEL AIRPLANES, R.O.G.

CLASS A

Junior: Joseph Pruss	Philadelphia, Pa.	10m 25s
Senior: Merrell Malley	Atlantic City, N. J.	10m 56.4s
Open: Michael Lichstein	Philadelphia, Pa.	8m 40s

CLASS B

Junior: Louis Shumsky	Atlantic City, N.J.	9m 15.2s
Senior: William Latour	Philadelphia, Pa.	14m 40.2s
Open: Michael Lichstein	Philadelphia, Pa.	11m 06s

STICK MODEL AIRPLANES, R.O.W.

CLASS A

Junior: James Shivler	Philadelphia, Pa.	3m 41.8s
Senior: Paul Karnow	Philadelphia, Pa.	5m 01.4s

CLASS B

Junior: James Mooney	Philadelphia, Pa.	8m 37.6s
Senior: Mayhew Webster	Philadelphia, Pa.	11m 55s

GLIDERS, Hand-launched

CLASS A

Junior: Kenneth Nelson	Boston, Mass.	26.6s
Senior: David B. Hecht	New York City	34.4s

CLASS B

Junior: Louis Young	Boston, Mass.	19s
Senior: David B. Hecht	New York City	31.6s

CLASS C

Junior: Stanley Congdon	Glen Ridge, N.J.	17s

AUTOGIROS

Junior: Raymond Steinbacher	Ridgefield, N.J.	57.2s
Senior: Alton H. DuFlon, Jr.	Ridgefield, N.J.	2m 01.2s

FUSELAGE MODELS, R.O.G.

CLASS B

Junior: Hyman Oslick	Philadelphia, Pa.	7m 59.6s
Senior: Herbert Greenberg	Newark, N.J.	12m 23.5s
Open: William Latour	Philadelphia, Pa.	6m 48s

CLASS C

Junior: Hyman Oslick	Philadelphia, Pa.	12m 59.4s
Senior: Emmanuel Enderlein	Philadelphia, Pa.	13m 24s
Open: Jesse Bieberman	Philadelphia, Pa.	6m 31.2s

FUSELAGE MODELS, R.O.W.

CLASS B

Junior: John Stokes	Huntingdon Valley, Pa.	3m 23s
Senior: Bruno Marchi	Boston, Mass.	3m 11s

OUTDOORS

STICK MODEL AIRPLANES, Hand-launched

CLASS C

Junior: Bruno D'Angelo	Philadelphia, Pa.	8m 29.4s
Senior: Vernon Boehle	Indianapolis, Ind.	15m 00s
Open: Bernard Collins	Providence, R. I.	3m 23s

CLASS D

Junior: Fred Skafec	Akron, Ohio	8m 21.6s
Senior: Ralph Kummer	St. Louis, Mo.	20m 54s
Open: Michael Marco	Springfield, Mass.	1m 52s

GLIDERS, Tow-launched

CLASS C

Senior: Bob File	Columbus, Ohio	23m 13s

CLASS D

Junior: Stanley Congdon	Glen Ridge, N.J.	45.2s
Senior: Fred Korn	New York City	1m 16.2s

AUTOGIROS

Senior: Ralph Kummer	St. Louis, Mo.	2m 06s

FUSELAGE MODELS, R.O.G.

CLASS C

Junior: Donald Mertens	Erie, Pa.	1m 44s
Senior: Russell Yungbluth	St. Louis, Mo.	11m 35s
Open: Bernard Collins	Providence, R. I.	2m 56s

CLASS D

Senior: Vernon Boehle	Indianapolis, Ind.	8m 43s
Open: Michael Lichstein	Philadelphia, Pa.	1m 28s

CLASS E (Gasoline Engine)

Senior: Maxwell Bassett	Philadelphia, Pa.	21m 57s
Open: Carl V. Carlson	Chicago, Ill.	6m 48.5s

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- Dewoitine D-33
- U. S. Army Martin Bomber
- Monocoupe 145-D

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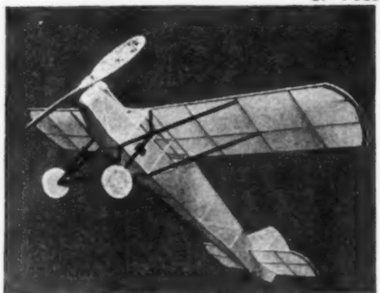

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Contents: Each kit contains full size plans, instructions, all ribs, formers, and curved parts clearly printed on best grade Balsa, special endurance rubber, cement, dope, wire, finished ready-cut wheels, tissue nose block, spinner block and Balsa strips cut to size. Only the best grade materials are used in G. H. Q. kits.

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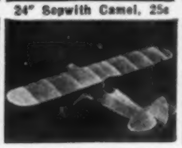

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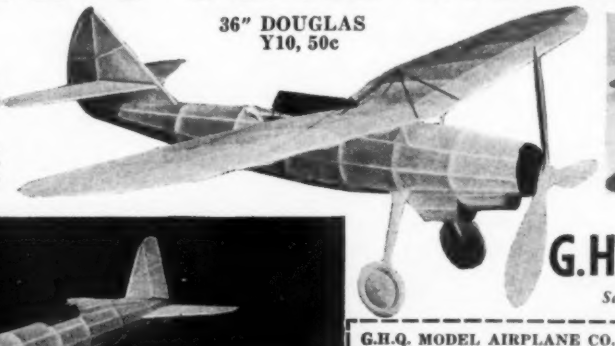
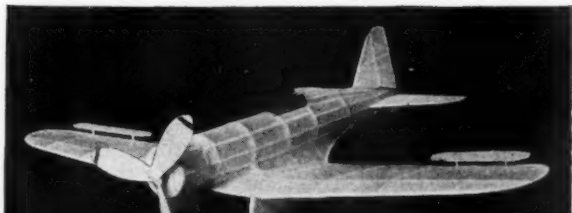


36" CURTISS A8 ATTACK, 50c



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- ☐ D.H. Comet
- ☐ Lockheed Orion
- ☐ Sikorsky S-41
- ☐ Douglas Airliner
- ☐ Dewoitine D-33
- ☐ U.S. Army Martin Bomber
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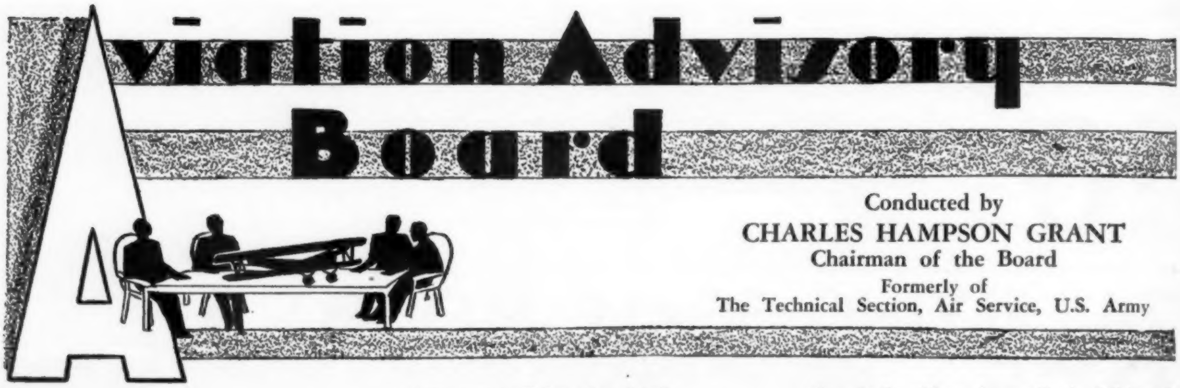

Aviation Advisory Board

Conducted by
CHARLES HAMPSON GRANT
Chairman of the Board
Formerly of
The Technical Section, Air Service, U.S. Army

HERE we are again with some interesting questions from our aviation friends. Possibly the answers will help to eliminate many doubts in your mind which have arisen during your interesting pastime of model building.

Question: If you put two strands of rubber in a plane and coat them with rubber lubricant, would it get power even if the plans of the plane told you to use one strand, or would the power be too much for the plane?

Answer: Yes, you certainly would get power. Whether you get too much power or not would depend upon the type of plane in which you made this change. Usually a plane is designed so that it will withstand the tension of the correct amount of rubber. If double the amount of rubber is added, the tension will probably be sufficient to twist the body of the plane out of shape, if not break it, especially if the ship has been well designed; inasmuch as a well designed ship is never made stronger than is necessary. Added unnecessary weight puts a greater load on other parts of the plane. The only way to determine whether or not two strands would be too powerful is to try it.

Question: Is it best to put a weight on one side of the propeller blade to make it turn better?

Answer: This question is very ambiguous. What side of the propeller are you referring to? We have never heard of adding weight to one side of the propeller to improve its performance, unless it was originally out of balance.

Question: Why are high aspect ratio wings more efficient than low?

Answer: This has been answered many times. However, briefly, it is because the air does not spill out at the tip of a high aspect ratio wing to as great an extent as in wings which are stubby and whose ends are very wide. When the air spills out of the end of the wing the pressure under the wing and the vacuum over the wing are greatly decreased, thus affecting the lift.

Question: Why does tapering a wing make it more efficient?

Answer: Tapering a wing makes it more efficient because the width of the wing tip is made comparatively small, thus reducing tip loss. The center of the wing, which gives the greatest amount of lift, is increased in size. This makes it more efficient also.

Question: Why does the shape of the tail surfaces differ so widely on various planes?

Answer: Various types of construction require different shapes to insure full strength. Also, the shape depends greatly upon the fancy of the designer. The shape is usually chosen which he feels will give great aerodynamic efficiency; that is, pressure up or downward with very little resistance or air disturbance.

Question: How do planes without dihedral obtain their inherent lateral stability?

Answer: They usually don't. A certain amount of stability can be obtained from the use of sweptback wings or a low center gravity, or a combination of both. However, the dihedral is the most effective means of obtaining lateral stability and any plane built without it usually is deficient in this quality.

Question: How does a free wheeling prop usually improve the flying qualities of a model?

Answer: The flying qualities are improved because the prop, when it spins freely while the machine is gliding, gives very little resistance and does not hold the plane back. When the prop is standing still, it is literally tearing through the air, causing eddies, whirlpools and a great amount of resistance to the plane's forward motion. This makes the glide of the model steeper than the case otherwise would be.

(We cannot understand Mr. Hamman's next question as the writing is very indistinct.)

Question: How does "gull effect" increase efficiency?

Answer: This wing increases the efficiency of the plane because it allows the designer to connect the wings to the body in such a manner that it is nearly perpendicular to the body's rounded surface. When a wing forms an acute angle with the body, disturbing and resisting air currents are formed. The more perpendicular the wing is to the body at the point of contact, the fewer air currents will result.

Joe Jackson of 816 Maple Street, Alva, Okla., wants to know the answers to several questions also. Here they are:

Question: What does the phrase, "safety factor of ten to one" mean?

Answer: This means that the structure of the airplane has been designed so that it will resist stresses equal to ten times the calculated stress for normal flight.

Question: What advantage is there in placing an extra wing between the motor sticks of a twin pusher?

Answer: There is absolutely no advantage. The only result is that greater drag is produced. Many designers claim that it makes the model steadier. However, the same degree of steadiness may be obtained by correctly proportioning the main wing and the elevator. Adding a third wing to a model airplane is, in fact, an admission that the rest of the airplane has not been designed correctly in the first place and that the designer wishes to be sure of the model's stability. He, therefore, adds a third wing which he feels, usually, will help conditions.

Fred Hovey of Clinton, Ontario, Canada, wants to know the following:

(Continued on page 48)

Here is one of the latest U.S. Navy fighters, the Curtiss XF13C-1. Its speed is said to be in the neighborhood of 280 m.p.h. Note the clear vision afforded the pilot and the retractable landing gear. Details of its design are being kept secret

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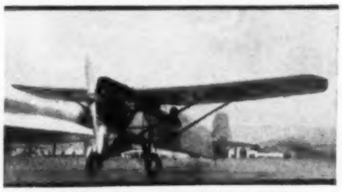

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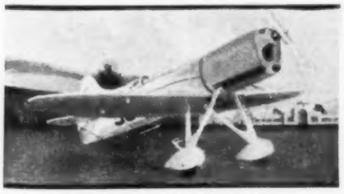
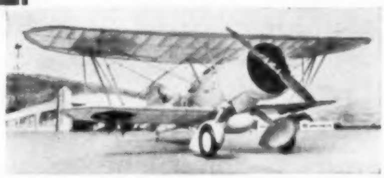


1933 HOWARD MIKE
5/8" scale Span 14" Length 11 7/16"
Benny Howard's sensational racer. Complete with oil tube on side of fuselage carburetor, exhausts with metal protection plates, etc. Colored all white with black and silver details. Complete kit 75c p.p.



Curtiss Goshawk F11C2
5/8" scale Span 19 3/4" Length 14 3/16"
An authentic flying scale model of the famous navy fighter. Complete to build. Motor, shock-absorbing landing gear, bombs, radio mast, auxiliary gas tank and all colored white, yellow, and red with black and silver details. Complete kit only $2.50 p.p.

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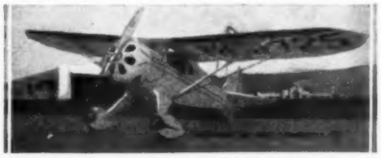
5/8" scale Span 20" Length 13 5/8"



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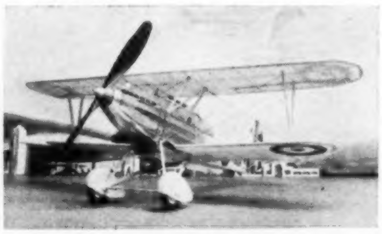

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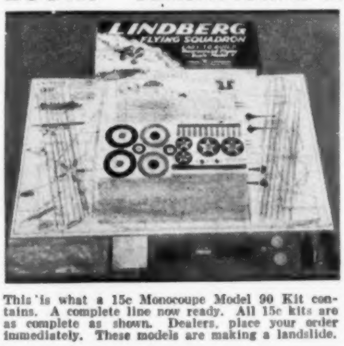

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Fundamentals of Model Airplane Building

(Continued from page 11)

around the block and the front ends of the sides.

While the cement is drying, cut out the top and bottom sides of the fuselage and the balsa block to which the rear motor hook is to be fastened. This block is to be 1 1/16" high, and 1½" wide. The corners of it are cut out 3/32" square to allow for the passage of the longerons. Next make the rear motor hook from 1/32" diameter steel wire. The shape of the hook is shown on the plan, marked "end hook." However, do not bend up the end of the hook into a "U," as shown, until after it is inserted in the block ¾" from its lower edge. The shank of the hook from the loop to the end which comes through the block, is 1 inch long. After the hook has been inserted through the block, bend it up into the position shown in the drawing and insert a half round hard wood dowel through the rear loop of the hook. Then pull the hook back firmly so that the point of the "U" passes into the block and the dowel presses tightly against it. Be sure that the face of the dowel which contacts the balsa block is firmly cemented to the block.

Now, when the front joint of the nose block is thoroughly dry, draw the rear ends of the fuselage together, inserting the block and end hook in place between the two sides and immediately to the rear of vertical struts G. Cement it in place firmly to the sides and to the struts. Hold it together with pins or a loop of rubber. Bevel off the rear ends of the longerons so the sides will come together at the rear.

You are now ready to put in the cross strips of the panels across the top and across the bottom. These strips are made of 1/16" balsa and extend from side to side. They are cemented to the rear of the vertical struts, at each panel. The upper ones should be flush with the top of the longerons, cutting out the corners in order to let them fit around the longerons properly. The bottom cross pieces are cut away at the lower corners for this purpose, each one to the proper length and inserted in place. This will give the body the proper shape laterally. It is wise to see that the body is true and not warped while these are drying.

Now, put on the top and bottom sides of the fuselage. They extend from line J to the rear. After the cement is dry the edges may be trimmed and rounded to give it a neat appearance. In the lower side, immediately in front of bulkhead G, cut an opening, as shown in the top view. This allows access to the rubber motor. Also cut a circle for the cockpit. Shape a piece of balsa for a headrest and cement it in place to the rear of the cockpit hole.

As this is your first attempt at constructing a square, built-up body, take care and do your work carefully, making sure that the body is true and not twisted or warped. How to glue and hold the parts in place have been given in previous articles.

Landing Gear

It will be best now to make the landing gear. It is of a little different style than on previous machines. It is formed in three parts, all of which are made from 1/32" steel wire. It is composed of a right half, left half and the axle. The two halves are joined at the center by holding together and wrapping them tightly with thread, after applying cement. This is shown in the front view on the underside of the fuselage. The wire should be bent so that the part which passes beneath the fuselage is 11/16" between the vertical bends of the chassis which extends backward along the sides. Notice that the front wire is slightly narrower between points than the rear one. When winding the thread in place, it would be wise to adjust the chassis before it is joined so that the distance between the vertical parts is the same width as the body where it is to fit in place. The front strut is made in actual length of 3⅝" between points. The rear strut is exactly 5 inches, as shown in the drawing.

The loop which is to retain the axle is shown in detail L. At the point where the wires cross each other, pull the loop. Thread may be used around the wires. Cement should be applied to hold the thread properly.

Next make the axle. This is bent at the center directly under the fuselage. The leg (H) is 3¼" long. The straight ends of the axle are ⅞" long. To complete the axle, pass the ends of the axle through the loops of the struts, slipping the wheels on the outer ends. These may be held in place by bending up the ends of the wire or by cementing a washer to the ends outside of the wheel. Allow ⅝" from the outside of the wheel to the point of the axle at which point it passes upward to a point near the fuselage. See front view.

Shock-absorbing effect may be produced by winding some fine rubber thread, 1/32" square, around the axle between the loop and the wheel, drawing the ends back through the crotch underneath the loop and winding them around the axle inside the chassis loop. After winding the rubber around in this manner three or four times, tie the ends in order to make the shock-absorbing gear resilient. Do not wind the rubber around tightly. A few attempts will tell you the correct number of loops and the amount of tension to use. The chassis is now ready to put in place when the fuselage is completed.

Tail Surfaces

Next cut out the tail surfaces as shown in the graph, putting on the reinforcing strips. These strips have been used on other models and you should be familiar with this operation.

Cement the stabilizer to the top of the body and the fin to the top of the stabilizer and in between the two rear sides of the fuselage. The rear part of the fuselage longerons should be beveled so the sides come flush together. The fin will fit in together between them nicely. Cement it in place tightly.

Wing

Next make the wing. The operations included in making this part have been thoroughly explained in previous articles. Briefly, the wing is made of 1/16" sheet balsa with ribs 1/16" wide and of the

form given in the graphs. Cement them in their proper places to the undersurface of the wing. The wing is cut at the center, fitted and cemented together so that the tips are raised 2 inches, as indicated in the drawing. When this is done, sand down the edges of the wing and cement on fine black thread along the edge around the entire wing. This trims the edge and prevents the wing from splitting.

Next make the center section struts from 1/32" wire. Dimensions for this are shown in the drawing. They are to be cemented to the wing when finished. The front one is located at a point ¼" from the leading edge and the rear one intersecting the wing at ¾" from the rear edge. Adjust their shape so they fit into place normally. Cement them tightly to the wing, each end of the strut coming inside of the second rib from the center.

Propeller

The propeller is made from a block as indicated on the drawing. Cut the blades in the manner given in previous articles. The outline of the blades are cut to shape by use of the propeller blade pattern shown at the bottom of page 11. Note that the cone in this machine is an integral part of the propeller. This should be cut round and out of the block at the propeller hub. The tip of the cone may be shaped and glued in place to the front of the propeller after the propeller shaft has been put in place. Before this is done, however, make a metal bearing which is ¾" in diameter and which has four prongs extending backward at right angles to the circular part of the bearing. This is made in the manner described in last month's article. When the propeller is finished, make the shaft from 1/32" wire and pass the bearing over the end of your shaft, points extending to the rear. Put two washers on the shaft and pass the end of the shaft through the propeller hub, bending over the end, pulling back into the hub, and cementing in place. Cement the tip of the cone to the front of the propeller hub. This forms the complete spinner, as shown in the side view.

Assembly

If you cut out your block correctly you will have a hole passing from front to rear through the block, which is ⅜" in diameter. This hole should be centered in the circle at the nose of the block, shown in the front view. Pass the rear end of the propeller shaft hook through this hole and press the prongs of the bearing back into the block, making sure that the bearing is centered. The outside ring of the bearing should coincide with the circle drawn on the front of the nose block.

Cement It in Place

Next make hook K from 1/32" soft wire. This should be annealed wire. It is shown in detail on the drawing. Bend only one hook before pushing it through the body sides, as shown at K, slightly to the rear of bulkhead A. When the strut end protrudes from the second side bend over this end into a hook similar to the one shown in the drawing by the dotted line.

Next you may cement the chassis in place to the fuselage. Make sure that it

holds firmly after the cement is dry, if not, apply more cement.

Next tie a rubber band at the upper point of the center of the axle so that the loops of the rubber band extend equally out from the axle. Loop one end over the right hook of K and the other loop over the left hook of K.

A trap door is cut in the underside of the fuselage between the nose block and panel A. This trap door is ¾" wide and 1½" high. To support the rear end, place a strut running from the lower left to the lower right longeron directly under vertical strut A and see that a part of it shows through the trap-door opening. Thus, when the trap door is in place its rear edge will be prevented from slipping into the body; the rear end resting on this strut. At the front end of the trap door a tape hinge is cemented to the body and to the trap door. Punch two holes through the trap door ¼" from the rear edge with a pin. The ends of fine rubber may be pushed up through this hole and knotted on the inside. Make it long enough so that the loop of the rubber may be hooked around hook K at each side of the fuselage.

To complete the body, cut out a celluloid windshield and put it in place. Also shape a tail skid out of .037 or 1/32" steel wire. The tail skid passes along parallel to the underside of the body for about half an inch, the end then passing up into the body. Use cement to hold it firmly.

A dummy engine is made from hard or soft balsa, as required to balance the plane at the point marked C.G. under the wing. This is made from a block of balsa 2¾" long, ⅜" wide, ¼" high at the rear and ⅝" high at the front. The undersurface is beveled and slightly curved to conform with the top of the fuselage when it is in place. If it is heavier than required to balance the ship, scoop out the inside of it slightly. If it is not heavy enough, lead shot may be pushed through the underside into the block. Cement this to the body so that the front end is half an inch from the nose of the fuselage, so that it blends into the circular bearing smoothly.

To make the machine a finished product, sand it all over, thoroughly rounding down the edges so that they are smooth. The four edges of the fuselage should blend gradually into its round nose.

Now, all that you have to do to complete the machine is to put the wing on the fuselage and strap it in place by means of the "S" hooks and rubber bands, as shown in the drawing. There are two "S" hooks on each side, a rubber band extending from one, under the body to the other, in the front and in the rear. For proper adjustment of the wing the lower edge of the center ribs should be parallel with the top of the body. If this is not the case put shims of 1/16" balsa wood under the cross pieces of the front and rear strut, as required to raise the front or rear. When the proper adjustment has been determined by several test flights, they may be cemented in place. They should be long enough to allow the shifting backward or forward of the wing. This may be necessary in order to adjust the flight of the machine. The motor of six strands of lubricated rubber is strung between the two hooks.

Flying

When you are ready to fly it, wind up the propeller for about fifty turns and launch it gently to determine the wing setting that will be necessary for correct flight. When the machine is thoroughly adjusted the motor may be wound to three hundred turns if dry rubber is used; four hundred turns if brown or black lubricated rubber is used and wound without stretching. If you want to use a winder, stretching the motor two and a half times its original length, it may be wound five hundred and sixty times. Of course, in this case the motor should be lubricated.

Do not attempt to fly this machine fully wound in a small space. The average flight, hand wound, will be about 400 feet. Winder wound, performance will approximate that of a contest model on many occasions. If you have any questions regarding the construction or operation of this ship, write in to the author, care of MODEL AIRPLANE NEWS. Good Luck!

Building the Grumman Fighter

(Continued from page 13)

Propeller

This is carved from a medium balsa block, 7 5/16"x1 9/16"x⅝". Mark the given outlines on the block with the utmost care, and cut the block down to them before you start to carve. This is very important for this propeller has been designed to have the correct blade area and true pitch. Don't change it at all, please. Carve the blades now carefully, giving them a moderate camber. Dope the prop after balancing it and put in the shaft. Don't forget that the hook must be bent after the motor is on the shaft, and don't forget to put in a few washers, too.

Covering

To cover the fuselage properly, use many small pieces of tissue. Work slowly and do a smooth job here. Dope it with water and then gray dope. Cover the rudder with red tissue but dope neither it nor the stabilizer, or they will warp. The stabilizer is yellow on top and white below. Use colored tissue. The upper surface of the upper wing is done in yellow tissue, but all the rest of the wings is done in white tissue. Dope the wings lightly and put on Navy insignia.

Assembly

Glue the rudder on squarely, then the stabilizer halves. Set these at zero incidence. Next fit the landing gear on, scraping the tissues away from the balsa where joints are made. This is also done where any gluing is done to papered balsa. Fit thin celluloid wheels of 1½" diam. Glue the lower wings to the two stub ribs carefully and block up the ¾" for dihedral. Glue the halves of the top wing together, then mount the wing to the fuselage, using the center section struts and some false framing to get things just right. The incidence is most important here. Have the leading edge raised just ⅛" above the trailing edge. Raise the tips ½" for dihedral.

Now put in the N struts which are built up beforehand from the plans. Glue them

in with plenty of cement. You can let the motor fit in with the square plug or you can glue it on lightly. String 3 loops of 1/8" flat rubber between the hooks, snap the tail plug in and the model is almost done. Fit aileron posts, the tailskid, and the "arresting gear" if you are going to fly your model from a carrier's deck!

Paint a red band 1 inch wide around the fuselage just behind the enclosure. Paint the large black squadron numerals on the sides, the black emblem, and the U.S. Navy lettering just under the tail. Touch up here and there, and there you are!

Get your model to balance on the leading edge of the lower wings and then try a bit of gentle gliding. Control 'er with your flaps, bending them with your fingers after breathing on them. When you get a nice smooth glide, try power. You can have a lot of fun flying this little model and then, too, it is so showy that you have almost an exhibition model. Good luck!

The Albatros Fighters on Parade

(Continued from page 9)

cross on Germany's warplanes was only a terrifying emblem of what it later proved to represent. It was the actual pioneer of the Albatros series and was probably the neatest and most compact little biplane produced by German engineers during the entire period of the war. Powered by a 135 hp. Mercedes, it had a top speed of only 80 m.p.h., yet its remarkable fighting characteristics in comparison with other early planes of that period, served to inspire a series which advanced in rapid succession to become the greatest and most popular line of warplanes of the German air force.

In the photograph of this machine, it is plain to note the advancement registered with the production of the thirteenth "D" type succeeding it, also the similarity existing between both designs. In taking up the brief description of the Albatros D-13, the fuselage was practically the same in construction and dimensions as the D-12. The nose, however, was changed in its form to accommodate the new Teves & Braun vertical radiator in front of the engine forming the end of the body toward the front. The tail was more or less the same as that of the D-12 but for the counter-balance of the rudder which was cut in a horizontal line where it met with the cross of the vertical fin. The wings are notable in view of the minimized depth of the cross-sections and backward slope which was lessened with the character of a speed-type plane.

The lower wing made up in halves was a very small affair with approximately half the chord length of the upper or main plane. Both wings were supported by a thin I strut on each side of the body, while the upper plane connected at the mid-wing section to the fuselage by a pair of N struts similar to the forms of the earlier D5a.

Only one pair of counter-balanced ailerons were used and these were connected to the upper plane being controlled by cables enclosed within the wing structure. No wire cables were used in bracing the planes.

The landing gear was the wireless unbraced type consisting of two struts connected to the body on each side spreading from the axle joints in V-fashion to the body connections at an angle of 35°.

The wheels were somewhat larger than employed in the undercarriage of the D-12, each measuring 760x100 millimeters. The track was reduced to 1750 m.m. The D-13 carried 54 liters of fuel in the main tank, 27 liters in the auxiliary and 14.7 liters of oil, sufficient for 1½ hours of flight.

Actual official figures rating the performance of this machine are unavailable to the author. However, it has been ascertained that the D-13, powered by a 160 hp. Mercedes, was an advancement over preceding types equipped with stationary engines of the same type and horse-power.

The Albatros D-14, produced in the fall of 1918 under the firm name L-46, was practically the same as its predecessor. The fuselage was changed at the nose, being somewhat deeper to accommodate the vertical radiator and newly accepted 180 hp. "B.M.W." engine. The customary effect of rectangular lower and curved upper sections of the body were retained, this effect being carried from the nose, graduating slowly to a horizontal knife edge at the tail. In the center at the region near the cockpit, the fuselage of this machine was not quite as deep as the foregoing type, but the body was slightly greater in length.

The wings were similar to the wireless forms of the D-13. The upper wing, how-

ever, possessed a deeper cross section for higher altitude flying. Two ailerons were employed only in the upper plane, which in this instance were not counter-balanced and controlled from within the upper wing structure as in the case of the D-13.

The lower wing made up of two halves was the thin camber type similar to the forms of the French wing and a half Nieuport 17. The interplane struts of the D-14 consisted of an I strut supporting the wings on each side of the body which were similar to the forms of our modern Laird Super Solution racing biplane of 1932. The mid-section struts connecting the upper plane to the body resembled those forms of the Fokker D-7, the N struts on each side being substantiated by an additional member connected to the leading spar of the upper wing and down to an auxiliary longitudinal member on each side of the body at the nose. No wires were used in bracing the wing structure of this machine.

The tail was more or less the same as the preceding forms of the D-12 and D-13. With the exception of slight changes in the forms of the struts, the undercarriage and all other details were similar to the forms of the preceding type and hardly important enough to be mentioned here.

The Albatros D-13 and D-14 as successors to the entire line of the Albatros "D" types, remained more or less in the experimental stages of production evidently owing to the approximate close of the war. However, these last two types were actually produced in material form and were subjected to the usual procedure in experimental tests to determine their strength in competition with other advanced single-seaters of that time. As nothing seems to be available in regard to the result of experiments with these final productions of that line, it is evident that the Armistice brought further working activities to a close.

One of the last two-seater Albatros fighters produced for front-line service was the Albatros J-1, which, like the B-2, was also used as a light bomber and reconnaissance type, doing most of its bomb-dropping by night. This ship was also classed as "an all-purpose machine." It was powered by a 200 hp. Benz 3a engine.

In judging the finest warplanes of the German Imperial Air Service, some of the war writers and aeronautical "philosophers" seem to have implied that Albatros was about the only comparison for the best that the German air force might have had, and that—it seems generally believed—was Fokker. These discussions of the outstanding single-seaters that veritably burned the skies for the Fatherland have given the Fokker D-7, Albatros D-3 and D-5a no end of unrest even so long after their official burials. As was previously mentioned, an explanation may be laid in the fact that the 1916 Albatros D-3 and 1917 D-5a were most desired and used extensively until the close of the war, in view of certain outstanding characteristics which no other German fighting plane possessed.

In concluding the series with the production of the Albatros D-13 and D-14,

the following statement quoted from the records of the Albatros-Werke conveys to the reader a brief narrative relative to the standing of the Albatros just before the end of military activities, after which time the Albatros-Werke diverted production along the line of commercial and sport type aircraft.

"The advancement in types of pursuit planes can already be noticed with the development of our last few designs. You will find in rotation the normally braced biplane, the triplane, and unbraced biplane with the high-speed motor. From these previously mentioned types, it can be seen that our prospects in regard to finer new constructions in the fall of 1918 were very good."

The Aerodynamic Design of the Model Plane

(Continued from page 27)

the number of strands composing a motor or the number of turns stored in it.

This being the case it is possible to evolve formulas which will give the correct values for the maximum torque developed by motors at the breaking point, the number of turns that a motor will safely absorb and the amount of work it will deliver, all in terms of the number of strands in the motor.

First, let us consider what the formula for maximum torque should be for dry rubber motors of various numbers of strands.

If you will study closely the manner in which the *maximum torque* varies in the various charts, you may be able to see that is varies approximately as $\sqrt{N^3}$ where (N) is the number of strands in the motor considered. There is a slight variation from this relationship in any particular chart, which is proportional to (N). So we may correctly say that:

$Q_{max} = K(\sqrt{N^3} + N)$ where (Q_{max}) is the *maximum torque*, and (K) the numerical constant which varies with various qualities and sizes of rubber.

A complete analysis of the curves has been made and the following formulas developed from it, which you will find fairly accurate and of practical value.

For motors of dry unstretched *brown rubber,* 1/8"x1/30" cross section;

$$Q_{max} = 0.286(\sqrt{N^3} + 0.34N).$$

For motors of dry unstretched *black rubber,* 1/8"x1/30" cross section;

$$Q_{max} = 0.21(\sqrt{N^3} + 2N).$$

For motors of dry unstretched *black rubber,* 1/16"x1/30" cross section;

$$Q_{max} = 0.09(\sqrt{N^3} + 1.2N).$$

For motors of dry unstretched *black rubber,* 1/32"x1/30" cross section;

$$Q_{max} = (0.0177)(\sqrt{N^3} + 5N).$$

For example, if we want to find the maximum torque of a 10-strand motor of ⅛x1/30 black rubber, we proceed as follows:

$$Q_{max} = 0.21(\sqrt{1000} + 2(10))$$
$$= 0.21(31.6 + 20) = 0.21(51.6), \text{ or}$$
$$Q_{max} = 10.836 \text{ inch ounces.}$$

In similar manner we have found that the number of turns that can be stored in motors of various sizes and number of strands varies as follows: where (TF) represents the *maximum number of turns* possible per foot of motor. For motors 2 feet long, multiply by (2), 3 feet long by (3), etc.

For motors of dry unstretched *brown rubber,* 1/8x1/30 cross section;

$$T_F = \sqrt{\frac{400{,}000}{N}} + N.$$

For motors of dry unstretched *black rubber,* 1/8x1/30 cross section;

$$T_F = \sqrt{\frac{470\,000}{N}}.$$

For dry unstretched motors of *black rubber,* 1/16x1/30 cross section;

$$T_F = \sqrt{\frac{1\,000\,000}{N}} + \frac{400}{N^{\frac{3}{2}}}.$$

For dry unstretched motors of *black rubber,* 1/32x1/30 cross section;

$$T_F = \sqrt{\frac{2{,}400{,}000}{N}} + \frac{900}{N^{\frac{3}{2}}} - 6.$$

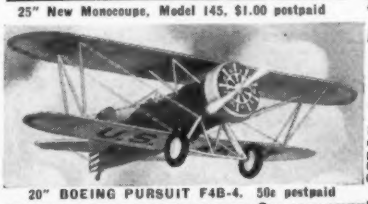
In order to determine the amount of

25" Vought Corsair, Model V80, $1.00 postpaid

25" Stearman, Model 81, $1.00 postpaid

25" New Monocoupe, Model 145, $1.00 postpaid

25" Great Lakes Sport Trainer, $1.00 postpaid



20" BOEING PURSUIT F4B-4. 50c postpaid

energy that will be delivered by a rubber band motor, it is useful to know formulas that will give accurate values for the maximum amount of available work in inch-ounces. The following formulas will give such values for various types of motors of *dry unstretched* rubber in which, (W) = *Work in inch-ounces.*

All motors are 1 foot long.

For motors of 1/8x1/30 *brown rubber*, $W = 12.5(32\sqrt{N} - 33)$.

For motors of 1/8x1/30 *black rubber*, $W = 12.5(28\sqrt{N} - 22.5)$.

For motors of 1/16x1/30 *black rubber*, $W = 12.5(10.3\sqrt{N} - 5)$.

For motors of 1/32x1/30 *black rubber*, $W = 5(14\sqrt{N} - 3)$.

Next month formulas will be given by means of which you can calculate the torque, turns and work delivered by unlubricated unstretched motors and motors which are lubricated and stretched two and one-half times their original length before winding.

It is hoped that the data given here will help you to be more successful in your model flying.

How to Build a Reliable Gas Engine Model

(Continued from page 23)

then get busy on the rib blanks. 6. You remember cutting out ⅛"x¼" notches at the top and bottom of the front and rear spar stations. Since the front and rear spars are full depth spars, the next step is to cut away the balance of the wood between the top and bottom notches at the front and rear spar stations. Each rib is now in three pieces, the leading section, center section and trailing section. 7. The final step in the making of the stabilizer ribs D' is cementing the 1/32" x 1¼" x length vertical shear braces to both sides of the center section of the ribs as shown on plan, 1P. To make stabilizer ribs E', make a cardboard template, mark out the ribs on balsa sheets, cut them out with a knife or razor blade, sand them lightly to shape, notch spar positions, and that's that.

Stabilizer Spars

The front spar is ⅛"x15/16"x35" medium balsa, while the rear stabilizer spar is ⅛"x1 1/16"x36" medium balsa. Mark out the rib positions on the spars, then bevel the top and bottom of each spar so that it conforms with the contour of the rib curve. Taper the ends of the spars as shown on plan, 1P. Make 4 bass hook bases N', then notch the spars as shown in the spar detail and cement the hook bases into place.

Stabilizer Assembly

There are three main steps in the construction of the stabilizer, the leading section, the center section and the trailing section. The first part to be assembled is the center section. Cement the center section of the ribs to the front and rear spars, taking care to line them up properly. Also, be sure to make a good cement joint. When this has had time to dry, cement the leading section of the ribs to the front spar, then cement the leading edge "G" into place. Cement the trailing section of the ribs to the rear spar "B," then cement the trailing edge "A" into place. Cement the 1/16"x width bass tip plates into place at the ends of the stabilizer, (See plate 3 for Typical Tip Construction). Then, when dry, round both the inside and outside of the tips to shape. Be sure that the stabilizer is lined up properly, then cement the drag struts "C" into place. The drag struts "C" run through the holes in the ribs, and are cemented to the middle of the spars. When dry, cement the center spars "D" into place. The tips of center spars "D" taper from ⅛"x¼" at the Rib D' terminal to ⅛"x⅛" at the tip E terminal. Make 4 attachment hooks "Q," using .033 music wire, cement and tie them with thread into the positions shown in the spar detail. The placement lugs P' are not cemented to the stabilizer until the complete ship is ready to be assembeld.

Pieces R' and S' are cemented on the bottom side of the stabilizer between the two center ribs, as shown in the top view of the stabilizer. Cover the leading edge, tips and center section of the stabilizer with 1/32" sheet balsa, medium soft grade. Leave open the bottom section of the stabilizer between the two center ribs and struts R' and S'. This is left open so that you may bolt the fin to the stabilizer. Cement a bass reinforcing plate M' (1/16"x1"x 1 1/16") to the rear center of the rear spar and a bass reinforcing plate M' (1/16"x 1¼"x1 5/16") to the front center of the front spar. Set the stabilizer frame aside for the time being.

Fin and Rudder

The fin is made in the same manner as the stabilizer. Make the cardboard templates for each rib, mark out the rib curves on the medium heavy balsa sheets and carve them to shape. Make the notches for the leading and trailing edges of the fin, the center spars and front and rear spars. Assemble the center section of the fin first, then the leading section, then the trailing section. Make the fin tip in the same manner that you make the stabilizer tips. Cement the center spars "K" into place. The center spars "K" taper from ⅛"x¼" at rib F' terminal to ⅛"x⅛" at tip "N" terminal.

Cover the leading edge and the two ends of the fin with 1/32" sheet balsa, medium

soft grade, as shown on plan.

Cement a bass reinforcing plate M' (1/16"x1¼"x1 5/6") to the rear of the front spar, and a bass reinforcing plate M' (1/16"x1"x1 1/16") to the front of the rear spar. The rudder, which is attached to the fin after the fin has been covered, is 1/16"x1½"x length sheet balsa, medium grade. 1" lengths of soft brass wire, app. 1/16" diameter, serve as hinges between the fin and rudder. One is cemented at the top of the fin-rudder axis, while the other is cemented to the bottom of the axis. The fin-rudder joint is further secured by applying a ¾" wide strip of adhesive tape to both sides of the joint.

Stabilizer-Fin Attachment

Cut two holes through the top of the stabilizer center-section, making them just large enough for the spar stubs of the fin to pass through. Set the fin snugly on the stabilizer, then drill a hole through both the front and rear stabilizer and fin spars, as shown in the Stabilizer-Fin Attachment Detail on plate 1. Bolt the fin to the stabilizer, taking care to have it perfectly in line. Cement bass fin supports O' to the rear of the front spar, and the front of the rear spar. Remove the fin from the stabilizer, taking care not to disturb the alignment of these fin supports O', then reinforce the joint with another coat of cement. That finishes the tail frames.

Wing—(Plate 3)

The first step in the construction of the wing is making the ribs. There are 31 ribs A' of 3/32" balsa web, 32 ribs A' of ¼" balsa web, 2 ribs B' of 3/32" web and 2 ribs C' of 3/32" web. A medium-hard grade of balsa should be used in the construction of the ribs. They are made in the same manner as the stabilizer ribs. When making the metal template for rib A', drill the ¼" holes for the bolts through the center of the 1" diameter circle in the leading section of the rib, and through the center point of the ⅝" diameter semicircle in the trailing section of the rib. When you make the cutout in the rib for the full depth spars of the wing, be sure to cut away only the equivalent of the balsa web of the spar (⅛" of the rib). The allowance for the cap strips is disregarded at this stage of construction. The cutaway for the cap strips is made on each rib just before the rib is cemented to the spars.

Wing Spars

The length of the balsa web of half the front spar "B" is exactly 47½". Since you may have difficulity obtaining a straight sheet of wood of even texture, this size, you will probably have to join two pieces to make each half of the spar. When joining these two pieces, do not use a butt joint, use a diagonal joint similar to the one shown in the Balsa-Web Joint Detail. Make each half of the spar about 6" oversized, or about 54" in length. Angle the two spar halves at the point they are to be joined, so that at the points 47½" from the center of the spar, the top of each spar half is 7" above the resting place of the center of the spar. (See Front Spar "B" detail, plate 3.) Don't forget that the center section of the spar is flat on the bottom 3" on each side of the center line,

or 6" overall. When you have angled the two spar halves correctly, cement them firmly together. When the joint has dried, mark out the rib positions on this balsa web of the spar, cut off the excess length and angle the tips as shown on plan. The cap strips "J" on the front spar taper from 1/32"x½" at the center, to 1/32"x⅛" at the tips. As with the balsa web, you may have difficulty obtaining a single strip of bass 1/32"x½"x47½", and you'll probable have to join two pieces together. Again you are advised not to make butt joints. Make diagonal joints. There are two ways to apply the cap strips to the balsa web. One is to taper the cap strip first, then cement it to the balsa web. The other way is to cement the cap strip to the balsa web first, then taper the cap strip. The second method is rather easier than the first and is as follows: Give the whole cap strip a coat of cement (you will have to work fast in applying the cement, otherwise it will be dry before you are ready to adhere the cap strip to the balsa web; use a brush to apply the cement), then adhere the cap strip to the balsa web. Allow the full ½" width of the cap strip to adhere to the balsa web at the center, but allow only ⅛" of the width to adhere to the balsa web at the tips. In order to insure a perfect taper, sight down on the spar and be sure that the cap strip is perfectly straight. When the cement joint has dried, cut the tapering excess width of the cap strip away with either a sharp knife or a small block plane (the block plane preferred). When you have cemented the top and bottom cap strips to both the left and right sides of the spar, cement the shear struts "I" (1/32"x½"xL) into position. Allow this face of the front spar to be the front face. When cementing the cap strips "J" to the top of the rear face of the spar, allow them to be about 1/32" above the balsa web of the spar. This allowance is made for beveling, 1P. When you have cemented the cap strips and shear strips to both sides of the balsa web, cement the balsa filler plates "M" (1/32"x fit) into place. Make the bass filler block "O" and cement it into place at the top center of the spar. Now make the bass tie plate "G." You have the pattern on the front spar detail, but will have to scale it up to size. When you have made this tie plate, cement it firmly to the rear of the front spar. Now you see that the purpose of the filler plates is to bring the balsa web into contact with the tie plate, so as to make a strong joint. Bevel the top of the spar to conform with the rib contour, and the front spar is finished.

The rear spar "E" is made in the same manner as the front spar. Be sure that you put the same amount of dihedral into the rear spar that you put into the front spar. To check this, lay the balsa web of the rear spar on the front spar. The bottoms of these two spars should coincide exactly! The cap strips "L" of the rear spar are 1/16"x½" at the center tapering to 1/16"x⅛" at the tips. The shear strips "K" are 1/16"x½"x length. In this rear spar, the cap strips on the top of the front face of the spar are raised 1/32" to allow for beveling. Cement filler block "P" into place. Since the tie plate is to be cemented to the front of the rear spar, cement the filler plates "N" to the front of the rear spar.

Wing Assembly

Cement the center section of the ribs A' to the front and rear spars. In order to do this, you will have to make a cutaway on each rib in order to allow for the cap strips. The two ¼" balsa web ribs A' you have made are each cemented to the points where the dihedral begins on the spars. The assembly procedure is to cement all the center sections of the ribs A' to first half of the wing. When you have these in place, cement the center sections of the ribs A' to the other half of the wing. Then insert the ribs A' that go into the center section of the wing. Cement the leading section of the ribs to the front spar, then cement the leading edge "A" into place. Cement the trailing sections of the ribs to the rear spar, then cement the trailing edge "F" into place. Cement the wing-tip plates "H" (⅛"x½"x fit) into place, and when dry, round them to shape. Then cement ribs B' and C' into place. Cement drag struts "D" into place and then the center spars "C." The ends of center spars "C" taper from ⅛"x¼" at rib A' terminal, to ⅛"x⅛" at tip "H" terminal. Cover the leading section, tips and center section of the wing with 1/32" sheet balsa, medium grade.

Covering

The covering procedure is as follows: Cover the entire leading edge first, starting with the bottom. Do not attempt to cover the whole leading edge at once. Cover only four to six sections at a time. First cement the balsa sheet to the bottom of the front spar. When dry, apply cement to the bottom of the leading section of the ribs and to the leading edge. Pin the balsa sheet to these parts until the cement has hardened. Moisten the sheet balsa at the leading edge of the wing, then bend it around the leading edge. Apply cement to the top of the leading section of the ribs and to the top of the front spar, and pin the sheet balsa into place until dry. Cover the bottoms of the center section. Then cover the tops of the center section and tips. The reason for covering the bottom parts first is that the sheet balsa will tend to pull away from the hollow at the bottom of the rib, but with the top section open while you are covering the bottom, you may remedy the trouble by either applying more cement at those points, or by pinning the sheet balsa to the framework, where necessary, until the cement hardens.

The wing and tail units are covered with a light grade of silk. Since many of you have not had any experience covering with silk, it would be advisable to start with the rudder first. Use medium heavy dope to cement the silk to the framework and remember to cover the entire rudder with the silk, including the balsa covered parts. Keep stretching the silk until you have taken all the wrinkles out of the covering. Do likewise in covering the stabilizer. When covering the wing, start with the underside and be sure that the silk sticks to the entire framework. Be doubly sure that it is well attached to the hollow at the bottom of the ribs, for, when the covering is complete and you dope the

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wing, there will be a strong tendency for the silk to pull away from the undercamber of the ribs as it begins to tighten. Cover both sides of the frame with silk before you start doping. Give the surfaces three coats of clear dope, allowing at least an hour between coats for drying. The three coats of clear dope must be applied with a brush. The two coats of colored dope that follow may be either sprayed on or brushed on. The original ship has a red-orange wing and tail, and a deep-blue fuselage. (The color scheme, however, is left entirely up to the builder of this ship.)

The second part of this article will appear in the next issue. Get busy now so you will be ready to complete the rest of the construction when your May copy of MODEL AIRPLANE NEWS arrives. Good luck!

On the Frontiers of Aviation

(Continued from page 17)

for a twin-engined version of the Delta model. This new Northrop is to carry 15-20 passengers.

The Lockheed Company, which is now working on an order for 50 Electras, is also producing a fighter version of their Altair model as well as an attack model similar to their XA-9 type with the Conqueror engine.

There is a rumor that the Menasco Engine Company is about to produce a light sport plane using one of their own famous engines.

Some of the above information must be accredited to Mr. R. M. McLarren of Los Angeles, Calif., who sent it in to us.

Numerous engine manufacturers are taking great strides in the development of new engines. Continental and Lycoming are both building 12 cylinder in-line-opposed engines and Allison Engineering is building a 12 cylinder V-type engine. All three are liquid-cooled and each develop 1000 hp. The Continental and Lycoming engines are flat types and may be buried in the wing for pusher propulsion. The engine to be used in the new 1935 Brown racer is a new military development. It is doubtful at the present time if the Brown Company will be able to obtain one of these engines at a very early date. The purchase money has been deposited in the bank by one of America's most famous flyers for the plane, so if the Government consents to the use of the new engine, America may once more regain the world's landplane speed record—and probably the world speed record for any type of plane.

Pratt & Whitney also have out a new engine known as the "E" Hornet which delivers 750 horse-power at 7,000 feet.

There have been some very authoritative reports that Howard Hughes, famous movie producer, is having a plane built for an 8-hour flight across the continent! The entire project, it is said, will cost him $300,000. This is a mere handful to Howard compared to the four million dollars he spent in producing "Hell's Angels." Maybe he is going to fly the new Brown racer.

Authentic word has come in that the Navy is contemplating the building of a giant bomber. Much secrecy surrounds

the venture. The plane will carry a crew of five with excellent living accommodations on board. It will be heavily armed and will be able to cruise for an exceedingly long distance, being able to stand up under very adverse weather conditions.

The Curtiss Navy fighter F12C-1, which has been undergoing tests for several months is a high-wing monoplane. The wing has a decided sweepback with landing flaps along its trailing edge. The landing gear is retractable as on the Curtiss Hawk Type III. The wing is connected to the fuselage by struts.

Bellanca has produced an improved version of the Skyrocket for 1935 production.

The new Cunningham-Hall GA-21M seems to be an ideal plane for the sportsman or private owner. The low-wing all-metal plane has a spacious cockpit for two occupants sitting side by side with individual head rests. A portable enclosure may easily be put over the single cockpit. Landing flaps extend the entire length of the wing. The landing gear is retractable into large fairings which extend down from the wing. Wing span is 30 feet and the power is supplied by a Warner 145 hp. engine.

The giant Martin flying boat, completed late in December for Pan-American Airways, recently has been going through its various test flights. Pan American plans to use it in their experimental service across the Pacific which will be inaugurated within the next few months. The plans on pages 18 and 19 of the huge plane give all the design details.

The plane has a wingspread of 130 feet and has a seating capacity of 46 when used on P.A.A.'s present international routes. Of course, on long flights across the Atlantic or Pacific, fewer passengers must be carried to allow for the added weight of extra gasoline. A cruising range of 3,000 miles with 12 passengers and a large load of mail is possible in the Martin, known as Clipper Ship No. 7.

In the forward part of the boat is the "bridge" where the pilot and copilot are located. Directly in back of that is a spacious compartment for the radio operator and directly underneath in the hull, is a huge mail compartment. Facilities for mooring are located in the bow. A baggage compartment and galley are located behind the radio and mail rooms and further aft are four passenger compartments, one of which is a lounge of huge proportions amidships. Sleeping quarters are available in the room furthest aft. In the rear of the boat over the second step, is the lavatory and in back of that is the companionway to the rear deck. In the turret structure that joins the tapered wing to the boat, is located the flight mechanic's room, which includes almost all dials pertaining to the four Pratt & Whitney double-row Wasp engines of 800 h.p. each.

The weight empty is 23,100 pounds and gross weight is 51,000 pounds. Total fuel capacity is 4,000 gallons and the wing loading is slightly less than on the

new Sikorsky S-42 Clipper Ships.

Sponsons, projecting out from the boat, take the place of wing floats.

How to Build a Scale Model of the Martin Clipper Ship No. 7

Plans Page 18-19

Balsa wood should be used in building the model. Get dimensions from accompanying drawings. Follow instructions and plans carefully, and even the beginner should have no trouble in constructing the model. Connect the corresponding dots on the border of plans with your pencil if you wish to square them off. Each square will equal 3 feet.

Make the boat first. Draw the outline of side view on wood and then saw. Go over the surface with coarse sandpaper. Draw top view on next and cut again with jigsaw. Go over these two newly cut surfaces quickly with coarse sandpaper. The four boat cross sections on Plan No. 2 show the contour of the boat. Following these, shape out the boat with a small sharp chisel. A razor blade should be used in cutting out the two steps in order to obtain sharp edges and corners. Note that under the bow, the outside edges are cupped (see cross section A-A). This cupping straightens out as it nears the first step. The bow is so cupped so as to keep a minimum of spray from flying over the windshield and into the props and motors. When the boat is completely shaped, draw the corrugations as shown on plans, pressing heavily so as to make grooves in wood. Then draw on door and windows. The small windows in the turret allow light to pass into the flight mechanic's room. The anchor, as shown, drops from the bow and is operated by a hand winch on the real plane.

Make the wing next. The wing is made most easily in four pieces, the dividing points being where the trailing edge changes direction. Draw the top view of the pieces first, making sure that the grain of the wood runs lengthwise with each piece and cut. Then taper off the pieces as shown in front elevation of Plan No. 2. Use a chisel. Next shape out the airfoil (see three cross sections of wing) with chisel. Do not make the trailing edges too thin. Take plenty of time. When finished, sandpaper thoroughly with coarse and then fine sandpaper. The four pieces may then be ambroided together, (glued). A tube of ambroid may be purchased in almost any popular department store or model shop. Lay the four parts on a flat surface and put small blocks under the wing tips and the center of the wing so as to give the wing the correct dihedral. Apply plenty of ambroid to the connections and allow it to dry thoroughly. Sandpaper the three joints carefully, holding the wing in your hands and not on a table so as not to change the dihedral angles when pressing down on the wood. Draw ailerons and landing lights on the finished wing.

Make the four engine cowls next. They are all the same and are perfectly round. Make the small nacelles and cowls all as one piece. Use a razor blade in cutting. Cut grooves in ends of nacelles so they will fit on leading edge of wing. Sandpaper the four parts when shaped out and ambroid them to the wing, using putty to fill up any cracks. The black rectangles shown on each side of the engines in the plans denote the folding platforms used in the repair and overhaul of engines. These fold out from the leading edge of the wing on the big ship and men can stand on them to work on the powerful engines.

The two finlike sponsons and tail, which includes the fin, rudder, stabilizer and elevators, are made in a similar manner. Draw the outlines of the pieces on wood and then cut. Then streamline them, using a chisel and razor blade and referring constantly to cross sections. Sandpaper thoroughly with coarse and fine paper. Draw the corrugations on the

bottom of the sponsons and the lines separating the rudder from fin and the elevators from stabilizer. Also draw on the tabs which, on the big plane, are to counteract torque and to equalize the tail as to the load carried.

Make the four 3-bladed propellers next. Cut these out of wood about 1/16 inches thick with your razor blade. Make the twelve blades separately and then ambroid them to the four hubs, also carved out of wood with your razor blade. Sandpaper the props thoroughly and insert straight pins through the center of the hubs to act as propeller shafts.

Cut out the twelve struts that join wing with sponsons and also the airspeed indicator shown on plans and then begin the assembly.

The wing should be connected to the boat first. Lay the boat on a flat surface with a block under the tail to keep the boat level, or in other words, in flying position. Also put a block under each side of the bottom to keep it from tipping over. Apply plenty of ambroid to the top of the turret and then fit the wing in place. Put a block under each wing tip. When the ambroid has dried, ambroid the two sponsons in place. Putty may be used in making the streamline fillets. Connect the four long wing struts next and then the eight smaller ones. Be accurate.

Ambroid the fin and rudder piece to the tail of the boat and when the ambroid has hardened sufficiently, connect the stabilizer and elevators to this piece. Use blocks in propping up the horizontal tail. Join the props to the engines by injecting the propeller shafts into the center of the cowls.

Go over the whole model with fine sandpaper and then brush off all the dust. The model will then be ready for painting. The large ship is painted silver with the exception of the top of the wing, which is red. The part inside the color lines shown on plans is to be painted or doped red. Paint the front of the cowls black and also the bottom of the boat the same color. The windows should be white. Several coats must be applied before a smooth finish can be obtained. When paint job is completed, connect up the "wiring." Use black thread in doing this. A looped piece of wire injected into the surface will hold the thread in place. The wiring should be done between sponson and wing and at the tail as shown on plans. Connect airspeed indicator.

The model will then be completed.

Air Ways—Here and There

(Continued from page 21)

MODEL NEWS FROM OTHER COUNTRIES

England

Mr. G. W. Broom, Jr., of 19 Ringcroft Street, Holloway, N. 7, England, has been kind enough to send picture No. 9 of a solid Curtiss Hawk F11C-2. It is the first American plane that he has built. The ship is built to a scale of 7/32 inch to a foot and is made of balsa and bamboo. Mr. Broom is a member of the Northern Heights Model Flying Club and has been building models for 4 years. He says, "Let me say a word about American and British model flying. It seems to me that the reason why you put up such records is because of the ideal weather you get. In England we get about 20 decent flying weather days per year. We hope to show you something in 1935 in the way of model flying." We trust that Mr. Broom will keep his word. American model builders will welcome any British fans who will personally attend our National Contest. We can assure them that they will receive every courtesy and enjoy their stay while in America should they see fit to attend. Our 1935 contest is to be held in St. Louis, Mo., at the end of June.

Germany

Very little news of model activities comes from Germany. Nevertheless, it appears that model builders in that country are extremely active. Picture No. 10 shows a workman repairing an all-metal radio-controlled plane which recently flew successfully. The damage was caused when the plane crashed, due to the radio-control apparatus failing at an inopportune moment. We have been unable to determine the form of power used in this ship. However, from inquiries and examination of pictures, it seems that there are three miniature gasoline motors mounted in the nacelles above the wing, as shown in the picture. These motors are a marvel as regards workmanship, there being nothing like them here in this country. We will welcome any further information from anyone who can tell us more about this ship.

France

Picture No. 11 shows the Coupe des Ailes held at Vincennes, October 1934. France has recently been very active in the model field and the hobby is spreading rapidly to all parts of that country. We are indebted to Mr. R. Boufflerd of 15 rue Ponscarme, Paris, 13eme, for this picture. Possibly some of the French model flyers may be encouraged to undertake a trip to America so that they may enter their ships in the 1935 National Contest.

Australia

Picture No. 12 shows the inaugural of the Gladesville Eagles, a branch of the Model Flying Club of Australia. In the center you will see three men, representing three generations, all model enthusiasts. In the center Mr. G. Ellick with the twin pusher, Mr. L. Ellick with the fuselage monoplane and, wearing a black coat, is his youngster, W. Ellick. This picture will help to give you some idea as to the enthusiasm with which model flying has been accepted in this country on the other side of the world. We are indebted to Mr. Ivor Freshman, General Secretary of the Club, for this picture.

CLUB NEWS

Hawkeye Hodel Aircraft Club

Picture No. 13 shows two model enthusiasts, Mr. W. D. Tolton and his son, Bill. They are both members of the Hawkeye Model Aircraft Club of Guelph, Ontario, Canada. It appears that now model flyers have become old enough to have youngsters of their own. If we are to take stock in Darwin's theory of evolution, we may expect that children will be

born with wings in a few generations. Mr. Tolton, as yet, has not noticed any signs of such a phenomenon in the case of his son. The ships in the picture speak well of the ability of the Toltons in regard to model building. Though the club has been in existence only 6 months, it is progressing rapidly in its activities.

Haaren High Aviation Club

One of the active clubs of New York City is the Haaren High School Aviation Club. Many Saturdays find them holding contests in Van Cortlandt Park. Picture No. 14 shows a group assembled at one of these auspicious occasions. We are indebted to Stanley Becher, president of the club, for the picture.

Eastern States Outdoor Model Contest

We have a little good news which many model builders in the East will be glad to hear. The Eastern States Outdoor Model Contest will be held on May 25th at Hadley Field, New Brunswick, N.J. The contest will be sponsored jointly by the Bamberger Aero Club of L. Bamberger & Co., Newark, N.J., and MODEL AIRPLANE NEWS. We expect this contest to be one of the biggest contests held in the East. All possible steps are being taken to provide worth-while prizes, an excellent flying location, and a meet that will run smoothly and give great pleasure to all. Hadley Field was selected because of its ideal flying facilities. Surrounding the field is open country, extending for several miles. It should be a "paradise" for gas model flyers. If indications are any measure, there will be more gas model entries in this contest than have ever been assembled in any one place.

The events will be: Fuselage Class C Duration, Twin Pusher Class C Duration and Catapult-Launched Glider Class B Duration. More detailed information will be given in the May issue of MODEL AIRPLANE NEWS or may be had by writing to the editor.

Bamberger Aero Club

Every Saturday the Bamberger Aero Club holds its regular meeting. At this meeting guest speakers talk on interesting phases of aviation. On Jan. 12 Mr. Charles H. Grant, editor of MODEL AIRPLANE NEWS, gave a brief talk on gasoline engine model propellers. There have been many conflicting ideas as to the design and as to the correct procedure in working out a gas model propeller for any particular ship. Having had some experience in this field, he passed on some useful information.

Picture 15 shows Mr. Grant explaining the details of the miniature spark plug used on the Brown Jr. engine to Miss Mary Walker, secretary of the club and one of the few young ladies who are active in the model field.

The club has planned considerable activity for the winter and spring months. There is to be a glider contest, three outdoor contests, the Eastern States Competition and finally, their participation in the National Contest in June.

Atlanta Model Airplane Club

John N. Burton, Jr., secretary of the Atlanta Model Airplane Club, sends a list of the records established by various members of the club. They are as follows:

Outdoors

Flying Scale	1 min. 34 sec.	Frampton Ellis
Baby R.O.G.	5 min. 16 sec.	Jim Lovett
Flying Fuselage	7 min. 20 sec.	Bill Paxton
Single Stick	3 min. 30 sec.	Frampton Ellis
Twin Stick	3 min. 5 sec.	Bill Paxton
Glider (H.L.)	1 min. 4 sec.	Bill Paxton
Glider (Tow)	1 min. 30 sec.	Jim Lovett
Free for All	4 min. 30 sec.	Frampton Ellis

Indoors

Baby R.O.G.	5 min. 9 sec.	Bill Paxton
Endurance Stick	5 min. 33 sec.	Frampton Ellis
Fuselage	5 min. 56 sec.	Jack Burton
Glider	19 sec.	Charles Bailey
Scale		Jack Coppage

The indoor contests are held in a small auditorium which does not afford much altitude. All their contests are carried on in accordance with national rules. We do not know whether Mr. Burton means National Aeronautic Association rules. Prizes are awarded on a point system. Trophy winners this year were John Burton with 78 points and Jim Lovett with 135 points. The membership roll is now over 135.

Westchester County Miniature Aircraft League

The winter indoor tournament of this organization will be held at the County Center, White Plains, N.Y., Saturday, March 30. Flying will start at 9:30 a.m.

This is one of the most important contests of the season. The events are as follows: Glider, all-wood type, hand-launched; Stick R.O.G. all-wood type; Endurance Stick Hand-Launched Class C; Commercial Fuselage R.O.G. All models except the Endurance Stick models will be under Class B. There will also be Exhibition, Scale, Solid Model, and Exhibition Scale Built-up Type events. Events will be held for beginners, juniors, seniors, and for builders over 21. All those who wish to enter this contest should write to Mr. A. D. England, Supervisor Miniature Aircraft, Room 238, County Office Building, White Plains, N.Y.

CORRESPONDENTS

The following readers promise to answer all letters sent them by other readers:

Ralph Bratte, 1018-39 Street, Brooklyn, N.Y.

Charles Hennessey, 210 Union Street, South Weymouth, Mass. Mr. Hennessey would especially like to hear from our friends in Germany. Will some write him?

Aviation Advisory Board

(Continued from page 32)

Question: Is it true that Anthony Fokker first offered his services to the Allies during the World War?

Answer: Yes, this is true.

Question: What is a ground loop?

Answer: A ground loop results when the directional control of a plane is lost by a pilot while he is taxying on the ground. The "loop" itself is a peculiar combination of spinning and rolling, usually with disastrous effects to both plane and pilot. It is due primarily to the condition which must exist in an airplane; that is, that the center of gravity is back of the wheels or the point of contact of the machine with the ground.

Paul Deveikis of 269 West Broadway Street, Gardner, Mass., wants to know:

Question: Is the area of a single surface wing the same as of a double surface wing of the same size?

Answer: Yes, it is. The area of the wing is the area of its projection upon the horizontal plane.

Speed Wings—

(Continued from page 6)

thought that if the cylinders of an air-cooled engine were not projected directly into the air stream, there would not be sufficient ventilation to keep it from burning up. A lot of aviation people shook their heads when this little ship took off with an N.A.C.A. cowl, looking for all the world like an inverted dishpan with the center knocked out, over the engine. However, the ship gave an excellent account of itself and such cowls have become the accepted thing.

Racing planes of the past few years have chiefly incorporated minor refinements to existing features rather than any radical changes such as took place during the earlier period. The immense value of racing craft to the advancement of aeronautics was summed up by the late Admiral Moffett, who said that more could be learned about construction and personnel from one air race than from a year of ordinary operations.